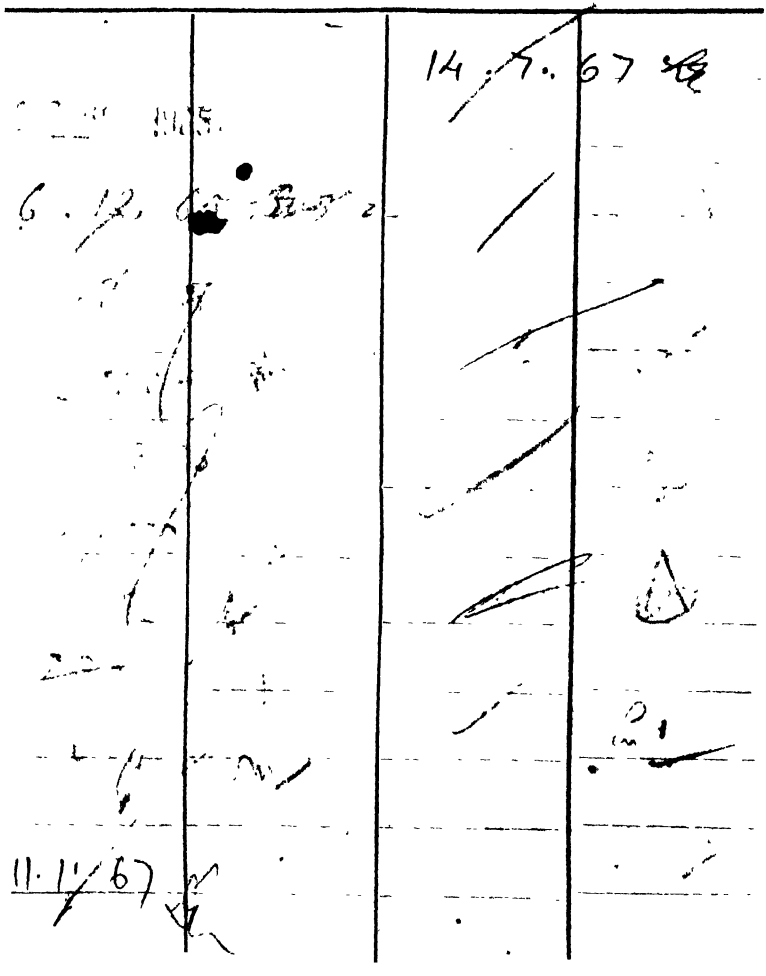

PLANNING THE UNIVERSITY LIBRARY BUILDING

PLANNING THE UNIVERSITY LIBRARY BUILDING

A SUMMARY OF DISCUSSIONS BY LIBRARIANS, ARCHITECTS, AND ENGINEERS

EDITED BY

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PRINCETON, NEW JERSEY

PRINCETON UNIVERSITY PRESS

1949

Printed in the United States of America by
Princeton University Press at Princeton, New Jersey

FOREWORD

ADDRESSED to librarians, architects, engineers and educators who are faced with the difficult problem of planning a university library building, this book is the result of an interesting experiment in cooperation among several institutions of higher learning. In 1944 President Harold W. Dodds of Princeton University invited the heads of fifteen colleges and universities in different parts of the United States to join in setting up a committee that would concern itself with problems common to all of these institutions in the planning of library buildings. The response to his invitation was a unanimous acceptance, and in consequence the Cooperative Committee on Library Building Plans came into being. The organization meeting of the Committee was held at Princeton on December 15 and 16, 1944. Since that date the Committee has held meetings at Columbia, Missouri (April 1945), at Orange, Virginia (October 1945), again at Princeton (June 1946), at Chapel Hill and Durham, North Carolina (March 1947), and at Chicago (January, 1948).

The Cooperative Committee was formed for the sole purpose of exchanging experience, ideas, and knowledge, and it was expected from the beginning that it would embrace divergent points of view. It has avoided the temptation to plan an ideal or model library building, and there has never at any time been any thought of imposing its preconceptions on any of the institutions which have formed its constituency, or indeed upon anyone else. It is in fact doubtful whether the Committee had any preconceptions. It has functioned entirely as a deliberative and advisory body, informal in procedure, flexible in its plans, and somewhat fluctuating in its membership. Though made up for the most part of librarians, with architects and engineers being invited to participate in its discussions, it has been a self-constituted group, sponsored neither by librarians nor by architects but by university presidents. Its activities have been a cooperative venture involving no commitments beyond the voluntary one of having each institution designate one or more librarians, faculty members, or

administrative officers to represent it. Advice, criticism, and counsel with respect to any particular building plan, freely offered by the Committee, could be freely accepted or rejected. All the institutions participating in the work of the Committee have doubtless had their building plans influenced in some degree by the give-and-take discussions. Some plans have been radically revised. Simplicity, efficiency, economy, flexibility, functional usefulness, and the avoidance of monumentality were cardinal points in most of the deliberations, but so were tolerance and the firm determination to avoid the arbitrary.

As the meetings progressed, it soon became apparent, as might have been anticipated from the start, that there would be many and important points upon which agreement could not be reached, and indeed upon which agreement should not even be sought. The reason for this lay in the disparity of size and objective as between the various institutions represented and, even when these disparities did not exist, in the sometimes fundamental differences of opinion as to the best means of achieving an agreed-upon objective. On the scale of the great state universities such as those of California, Wisconsin, Michigan, and Iowa, such institutions as Princeton, Rice Institute, and M.I.T. are physically small. Yet all of these institutions were represented at the conferences. There were institutions which necessarily have to admit large numbers of students of many types and many ambitions and degrees of preparation, and others which are very selective and have a homogeneous student body. There were institutions whose objectives are limited to the training of superior professionals in but a few fields, or even a single field, and institutions whose responsibilities run the gamut of higher education; institutions which bear a heavy responsibility to world scholarship and hence have large and deep collections of no direct significance to the local needs, and others which have and seek no such responsibility.

Thus no honest report could really arrive at dogmatic conclusions, and the reader who seeks in this monograph unequivocal and precise instruction as to how to solve his own problems is foredoomed to disappointment. However, it may fairly

be said that the report does manage to cover most of the important problems which are likely to arise in preparing the program for a college or university library building. It attempts to discuss the advantages and disadvantages of the various attacks which have been made upon these problems, or proposed; and it should provide a reasonably complete checklist of the matters to be considered.

The way to use the volume, then, is to consider each question and to make a decision on the basis of the argument and the local conditions. If such a procedure is conscientiously followed, it is believed that an improved program will result. Indeed, such a procedure should be far more satisfactory to the alert librarian and architect than the slavish following of rules.

The following list of participating institutions and their representatives on the Committee suggests the broad diversification of library viewpoints, needs, and geographical location that the Committee embraced: Duke University, B. E. Powell, Librarian; Harvard University, Keyes D. Metcalf, Director of the Library; Massachusetts Institute of Technology, formerly represented by John E. Burchard, now Dean of Humanities, and later by his successor as Director of Libraries, Vernon D. Tate; Princeton University, Julian P. Boyd, Librarian; Rice Institute, Claude W. Heaps, Chairman, Library Committee; Rutgers University, Donald F. Cameron, Librarian; State College of Washington, formerly represented by W. W. Foote, Librarian, and now by his successor, G. Donald Smith; University of Indiana, Robert A. Miller, Director of Libraries; State University of Iowa, Ralph E. Ellsworth, Director of Libraries; University of Maine, Louis T. Ibbotson, Librarian; University of Michigan, Warner G. Rice, Director of Libraries; University of Missouri, formerly represented by B. E. Powell, Librarian, and now by R. H. Parker, his successor; University of North Carolina, Charles E. Rush, Director of Libraries; University of Pennsylvania, Charles W. David, Director of Libraries; University of Wisconsin, Ricardo Quintana, Chairman, Library Committee. Among the architects who have attended meetings of the Committee are the following: Edgar Albright, Alfred M. Githens, Fred Hammond, John F. Harbeson, George Howe, George Horner, Earl Jones, Walter H. Kil-

ham, Jr., Roger Kirchoff, Sherley Morgan, R. B. O'Connor, Henry R. Shepley, George Spearl, John F. Staub, Ides van der Gracht, S. F. Voorhees, Ralph T. Walker, and W. W. Watkin. Others who attended as trustees, administrative officers, or professors of institutions of higher learning included President Virgil Hancher of the University of Iowa, President David A. Robertson of Goucher College, the late Harry C. Wiess, trustee of Princeton University and of M.I.T., Walter W. Stewart of the Institute for Advanced Study, Princeton, and Professor E. Baldwin Smith of Princeton.

The ideas that were generated in the Committee, the complete but amiable candor with which plans of buildings were discussed, and the generosity of architects and librarians in sharing their knowledge, experience, and plans soon caused the Committee's work to be widely discussed in print and in professional meetings throughout the country. As a result of this gratifying comment, many institutions—numbering perhaps two or three times the list of those that had called the Committee into existence—applied for membership in the group. It was not possible to grant these requests without destroying the informal, congenial, seminar-like quality of the meetings, though from the beginning all members of the Committee have recognized that they had a responsibility extending beyond the needs of the particular institutions they represented. Some of the original members of the Committee, whose library building plans are in such an advanced state as to be incapable of further improvement, or are beyond redemption, have recently helped to meet this demand by accepting a status of inactive membership, thereby making it possible for others to become participants. But, since the Committee wished a much larger audience to share some of the expert testimony that had informed its meetings, it applied for and received a grant from the Rockefeller Foundation to enable it to prepare and distribute full reports of its meetings and to publish a monograph-report that would endeavor to focus the best opinion available on such problems as present educational trends as they affect libraries, technological trends as they apply, or may apply, to library and scholarly uses, library administration as it affects, or is affected by, library buildings,

and such engineering matters as lighting, new modes of construction, etc.

The actual preparation of this volume was likewise a cooperative effort. Most of the initial draft was prepared by our editorial associate, LeRoy C. Merritt, now a member of the faculty of the University of California School of Librarianship. His draft was discussed and considerably altered at the second Princeton meeting of the Committee. A revised draft was then prepared by Mr. Merritt and submitted to an editorial subcommittee, whose chairman, John E. Burchard of the Massachusetts Institute of Technology, combined experience in both architecture and librarianship with a perceptive mind and a ready pen. Under his stimulating direction the subcommittee held several meetings, rewrote or drastically revised the entire manuscript, and then submitted the result of its work to three specialists: Keyes D. Metcalf, Director of the Library, Harvard University; Ralph E. Ellsworth, Director of Libraries, State University of Iowa; and Robert B. O'Connor of the architectural firm of O'Connor and Kilham. The manuscript received further changes and improvements as a result of the criticisms of these competent specialists. The task of putting it into final form for the printer has been mainly performed by Charles W. David, formerly secretary of the Committee.

This detailed account of the method of preparing this study has been given partly to indicate the pains we have taken to make it useful to librarians and architects, partly to give me an opportunity to express gratitude to all who have contributed to it. I think those who have shared in the work of the Committee will agree that, in apportioning this gratitude, the major share should go to Mr. Burchard for his industry, his leadership, his many-sided expertness, and his insistence upon a realistic approach to all problems, based upon sound information. Chapters VII and VIII are almost wholly his work. To the officers of the Rockefeller Foundation whose grant made this volume possible; to W. Ward Powell, Jr., of Massachusetts Institute of Technology, who was mainly responsible for the chapter on air-conditioning; to LeRoy C. Merritt for his essential labors in preparing the first draft of our manuscript, in suffering patiently through its drastic revision, and particularly

in compiling the useful chapter on bibliographical references; and finally to Charles W. David for his assiduous and competent effort as secretary and editor to the special subcommittee, I desire to express cordial appreciation.

The present volume is, therefore, a result of the Rockefeller Foundation grant and of the Committee's desire to share its experiences with a wider audience. The Committee hopes that this study will be as useful to others as its discussions have been to those who have attended its meetings. It regrets that the friendships, the congeniality, and the lighter moments that characterized its meetings could not also be disseminated to a wider audience. But such things, like delicate wines, do not transport well.

JULIAN P. BOYD,
Chairman

Princeton, N.J.
January, 1949

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CHAPTER I

THE LIBRARY IN THE UNIVERSITY

New methods of building construction, new techniques of librarianship, and new theories of library design and internal arrangement, some of which are now available and others of which, even more revolutionary in character, appear to be imminent, make library planning for the future a hazardous task. Yet the effort needs to be made. The attempt to establish principles of good library planning has been made before. Just half a century ago Charles C. Soule, a trustee of the Brookline Public Library, published "Points of Agreement among Librarians as to Library Architecture."[1] Thirteen of Mr. Soule's twenty "points" are directly concerned with the planning of the building, and nine of these are still pertinent:

1. A library building should be planned for library work.
2. Every library building should be planned especially for the kind of work to be done, and the community to be served.
3. The interior arrangement ought to be planned before the exterior is considered.
4. No convenience of arrangement should ever be sacrificed for mere architectural effect.
5. The plan should be adapted to probabilities and possibilities of growth and development.
6. Simplicity of decoration is essential in the working rooms and reading rooms.
7. A library should be planned with a view to economical administration.
8. The rooms for public use should be so arranged as to allow complete supervision with the fewest possible attendants.
9. Modern library plans should provide accommodation for readers near the books they want to use, whatever system of shelving is adopted.

These principles have a modern flavor; they parallel many

[1] *Library Journal*, XVI (1891), San Francisco Conference Number, 17-19.

of the most important suggestions in this report—from planning a building from the inside out to accommodating readers near the books.

New technical potentials can, however, add something important to Soule's desiderata of fifty years ago. Structural engineering has made it possible to provide an internal flexibility beyond the wildest dreams of the nineties, while at the same time the relative security and certainty of that decade is missing from ours. These two factors, one physical, one social, cause this report to emphasize the need for flexibility far beyond the implications of Soule.

The second technique is that of air-conditioning, a necessity for the modern library under most climatic conditions. Beyond its advantages in the preservation of books, and in the comfort provided for human beings, air-conditioning makes it possible to consider seriously a library with no windows. Our mores may defer the realization of such a possibility, but it nevertheless exists. Once this is recognized, a further consequence is apparent: emphasis on natural lighting is no longer so important as it once was. Recent improvements in artificial illumination, of course, support this possibility.

Thus a set of criteria similar to Soule's would today differ in tone and emphasis, and would carry the added concepts of flexibility and freedom from the chains of fenestration; otherwise they might not be significantly different. In all candor it cannot be said that many of the library buildings erected subsequent to Soule's paper have accorded with his points. Had they done so, there might have been less need for the present report.

Soule's second principle, that a library building must be planned to serve the purposes of the library and its community, is obvious, but as applied to university libraries it requires comment. Just as the modern university is an institution of complex and diversified interests, so the university library is an agency of varied functions. These functions are necessarily in a constant state of flux, since the library inevitably reflects the changing educational pattern in the university and in the society which it serves. Moreover, the university library must

not only keep abreast of current change; it must also anticipate, so far as it can, the direction of future change. However, admitting the difficulties inherent in such a situation, there are still two fundamental responsibilities of the university library which remain constant. First, it must provide materials needed for carrying out the program of undergraduate instruction, and, second, it must provide a reservoir of research materials for advanced students and faculty.

The first of these requires a large amount of reading space for the most numerous segment of the university community, but a relatively limited number of books and other library materials. While it is not necessary for the books to be shelved in the reading area, they must be easily and quickly accessible, with as few barriers as possible between the reader and his assignment. The second responsibility requires smaller reading areas, but collections of books and other library materials which are limited only by availability and resources; for a graduate program draws unto itself all that it can of past and contemporary knowledge.

There is no single ideal way in which to meet these divergent responsibilities and no formula to determine for all institutions a uniform distribution of emphasis between them. It is unlikely that any university or college administration can chart a course forward as far in time as a library building is likely to endure. What does emerge clearly from past experience is that universities have built library buildings which have not been sufficiently adaptable to serve varied and continually changing educational programs. What is not so clear is the extent to which such buildings have limited not only library activities but even the fullest expression of the newer aspirations of the university.

The best solution for a small institution which is determined to remain such is doubtless that of carrying out these different and sometimes opposed activities under a single roof, since, despite their oppositions, each may help the other and each may draw increased benefits from the juxtaposition. For the very large institution, however, such a solution may prove undesirable even when a library building can be erected *de novo*. There is clearly a limit to the size of a single building

beyond which the law of diminishing returns begins to operate. Where great size has to be reckoned with, a more intelligible and efficient solution may be found in a group of buildings consisting of a central unit and a series of satellites judiciously disposed upon the campus.[2] The full potentials of such an orbital arrangement will be realized, however, only when the outlying units are in a planned relation to one another and when the library administration is able to take full advantage of contemporary possibilities in communication and transport. The first split from the central building has occurred historically, as a rule, with the breaking off of a department or division from the central cell. The separation of undergraduate needs from research needs is a newer though not a surprising development. In any event it is clear that the university library building, or buildings, must be sufficiently adaptable so that division, if it occurs, is the result of planning and intention, and not forced by the architecture of existing structures.

Planning of libraries for experimental "teaching with books" programs can proceed with the greatest hope of success only in the full acceptance of the principle of adaptability. If these programs are deemed unsuccessful in two years, or ten, or twenty, or if the simple storage of books becomes more pressing than the demands of a complex instructional program, library buildings must be easily and readily adaptable to the resultant situation. Or, conversely, if these programs prove so successful as to demand a doubling of reader facilities in two years, or ten, or twenty, contemporary library buildings must be readily adjustable to accommodate the increased service demand, even though simple storage of books is pushed out of the library entirely.

But these are extreme cases, which would call for extreme measures should either situation develop. Normal change in educational programs and in demands on library facilities is likely to occur more slowly and less abruptly. Even so, it is imperative that library buildings planned today—buildings which will, if only for economic reasons, stand for fifty years or more—should be planned wisely and well for today's needs,

[2] The subject is further developed below, Chap. II, pp. 17-20.

with, in addition, much thoughtful consideration of the probable effects of future changes of educational policy.

No one can, of course, know what the ultimate policy of an educational institution is going to be, nor what specific changes will occur in a future educational program, but decisions upon such matters profoundly affect the librarian's actions, and his actions in turn affect the success with which policies are carried out. For example, an administration might decide without consulting the librarian (such things certainly have happened in the past) to undertake a substantial program of supported research. This might in turn call for important additions to the existing accessions program of the library. If then budgetary considerations should offer difficulties, it would either come about that the new program would not be properly supported by the library or that some older program would have to be sacrificed. Hardly any university activity, and certainly none at the intellectual level, can be altered without altering the library accordingly. It follows that if the librarian is to decide to buy or not to buy certain books, or categories of books, because of their relevance or irrelevance to the university's educational program, he must know a great deal about the trend and intent of educational policy. Conversely, it will be well for an administration not to change policy or to introduce new policy without learning in advance the degree to which the library can support the change without having to ask for additional financial or other support.

The librarian did indeed occupy an important position in policy-making in the early days of American universities, and there is much evidence that he is being restored to it in current best practice.

However, the matter extends far beyond the limits thus far indicated. Even more than in the management of current operations, the librarian needs to know the program of the university when he undertakes to plan a new library building. Even more than in surveying the policy of the immediate future, the administration needs to consult the librarian before it entrusts the new building to the architect. A minimum requirement for a successfully planned library can be categorically stated: the librarian must be a part of the authority set up by the univer-

sity in the earliest stages of library planning; he must be constantly in touch with the architect through all stages of planning; he and his advice on what the university needs for a library must have greater weight than that of the architect or the donor. If the librarian is not of sufficient stature to justify such a trust, he should be replaced by another who does justify it.

This may seem so obvious as not to require stating. But the fact remains (though this will not explain all the mistakes) that American campuses are littered with library buildings in the creation of which the librarian was ignored; and it is also a fact that at the very minute of writing this report there are administrative officers on some campuses of America who have short-circuited the librarian in the planning of one of the most difficult types of building, technically, which is ever erected at an American university.

Now, though the librarian should be fully familiar with all matters of educational policy, not all of them need affect the building. Conversely, though a particular library structure may permit any desired emphasis on certain types of university activity, for others the library type may impose severe restraints. Those matters, then, which depend upon a certain type of library organization for their success are so important that an extended discussion of the planning of library buildings cannot profitably proceed without some prior attention to them.

General Education. Although the phrase means different things to different people, general education may be defined as that type of education which aims chiefly at the orientation of youth to the world in which it lives and at the promotion of the concept of combining living with service to society. Its purpose is not only to impart information, but also to assist in cultivating proper and useful attitudes. However it may be specifically defined or implemented on a particular campus, the existence of a general program carries with it significant implications for the library and the library building.

For the library a program of general education normally involves a departure from closed bookshelves in favor of an open access arrangement. It demands less reliance on a single

textbook and less reliance on its library counterpart, a handful of reserved books in which required readings are assigned. It also involves physical arrangements which bring the teacher, the student, and the books together in an atmosphere of work and study. Such a relationship carries on past the class hour and calls for facilities whereby the library staff can continue the work of the professor. Libraries have found that more reference work is called for when the task of general education is being handled well.

Almost any plan of general education demands something special in the way of library facilities. Specific arrangements must be worked out in each institution as the program is developed. The important consideration here is that the planning and facilities of a library building must take cognizance of existing and projected educational programs, in a manner to allow the librarian to rearrange physical facilities at any time.

Faculty-Student Relationships. There is a clear trend in American universities and colleges to return to the older pattern of university life and to break with the custom of having the majority of students known to the faculty only through the classroom. This is manifested in arrangements for better students to work more closely with the faculty through honor systems, tutorial systems, and similar devices. There is a desire to extend such arrangements throughout the university, to individualize the work of the student, to place the initiative for learning on him, to provide a working arrangement which will break down the formality of relationships between students and faculty. Though the desirability seems well enough accepted in principle, it is also true that such hopes cannot be realized in full within the economic resources of universities as now constituted. The program needs every possible additional support. There is substantial agreement that the library is one of the most appropriate places in the university in which to foster closer faculty-student relationships. Hence the planning of the library building should proceed with this in mind.

Teaching in the Library. In many university libraries it will be necessary to provide space for new methods of teaching and for the teaching of new subject matter. An increasing emphasis

on knowledge and understanding of the contemporary scene implies that faculty and students will work together on unsolved problems from documents and other sources which are not so easily and neatly organized and used as are the materials for courses taught from the historical point of view or from book sources only.

The problem, when faced directly, will require the careful attention of librarians to materials which they have been calling fugitive, special, research, or even "non-library." Books will be used, of course, but so will political tracts and broadsides, government publications, and the output of special interest groups; motion pictures, slides, film strips, and microfilm; radio transcripts and other sound records. Literally nothing in the way of documentary evidence will be beyond the scope of such firsthand investigation.

The historical pattern of university library administration has been one of discouraging teaching in the library. The existence of instructor-advisors in the College Library at Chicago, departmental assistants at Teachers College, Columbia, library counselors at Brown, and library faculty members at Stephens[8] and elsewhere indicates, however, a growing desire to assist the student in making a more intelligent and fruitful use of the library. Even though most formal instruction may be carried on elsewhere, certain subjects can best be taught in the library near the relevant materials. Courses in art, bibliography, and industrial relations are obvious examples.

More informal teaching in the library will come about naturally along with the organization of a program of instruction which provides the student with stimulus, time, and opportunity for a larger degree of individual initiative. Such a program has already been published for the University of Iowa: "The library is to be both a building and a program. Rather than a great architectural monument, the building will be a sensible workshop in which the instructor and the student can work together in the midst of the book resources of the University, aided by the latest audio-visual aids to learning and by adequate facilities for group and individual study. As a pro-

[8] Harvie Branscomb, *Teaching with Books*, Chicago: Association of American Colleges and American Library Assn., 1940, pp. 208, 76.

gram, it is a comprehensive attempt to place within a building a great number of activities in which the medium of print is necessary to a successful program of action."[4]

Place of the Undergraduate. Fear lest the undergraduate be lost and bewildered among the millions of books in our great university libraries has led some institutions to provide a much smaller independent collection for his use. Such a collection at Harvard is being housed in the new Lamont Library, a building for undergraduates. But facilities for the undergraduate could just as well be located in a central building, though the undergraduate department and collection are desirably kept separate from the research and advanced study functions of the library.

This has already been done in the Butler Library, formerly South Hall, at Columbia University, where the College Library has its own catalogue, reference collection, secondary course material, and general stack collection. Most of the material which the undergraduate will need is there; needed material not there is immediately available to him in the other collections of the university library. The new library at the State University of Iowa will contain a similar department, to be known as the Heritage Library, where all material of use and value to the undergraduate in studying and appreciating his cultural heritage will be housed. Required reading for courses in the "core" curriculum will be located in the Heritage Library. Books used so frequently as to be placed on reserve will be shelved along with all other books in the library, thus inevitably bringing the undergraduate into contact with books other than those to which he has been specifically referred.

The conventional reserve-book room, now found in most university libraries, is developing into a much larger collection of books for the use of the undergraduate. Here he will find not only reserved books but also others which may serve his purpose equally well or better, and in so doing he will learn how to use a larger collection of books—and be prepared for intelligent entry into the even greater collections of the whole university library.

[4] *The Library as a Teaching Instrument*, Iowa City: University Library Planning Committee, 1945, p. 5.

Library Specialization. Division of labor among neighboring institutions has manifested itself in specialization agreements whereby two or more great libraries cease their competition for materials in certain well-defined fields.[5] The logical next step of transferring collections in line with these agreements will come more slowly, but it is none the less inevitable if problems of library growth and use are faced realistically. Implications for library planning in the two phases of specialization include (1) adequate inter-library loan facilities, (2) adequate photoduplication services, and (3) a flexible building capable of losing and gaining large blocks of materials in widely separated subject fields, stack locations, and areas of service.

Responsibility to the Community. The modern university is not something set apart, an institution aloof from and even at odds with the community in which it exists. It draws its support from and ministers to the community and the nation, and it has a responsibility to both. This responsibility the university library shares, and it may be expected to make increasing provision for service to the community, above and beyond its duty to students, faculty, and administration.

Princeton University, in designing a library to serve 2,200 undergraduates, plans to serve 3,500 readers, the balance to be drawn from the community, neighboring institutions, and visiting scholars. Exhibitions, public lectures, literary and musical events—all must be planned to include probable attendance from interested and enlightened citizens living on the fringes of the campus. Other specific services to the community, its business and industry, its recreation, and its enlightenment are legion—and the future is apt to suggest many more for which provision must be made.

Responsibilities to region and nation may also be expected to grow. The University of Pennsylvania, host to the Union Library Catalogue, is performing a service to the region and the nation which will find accommodation in its new library building. All great libraries perform an untold amount of regional

[5] Robert B. Downs, "American Library Cooperation in Review," *College and Research Libraries*, VI (1945), 407-15, and Keyes D. Metcalf, "Division of Fields of Collecting," *ibid*, 417-19; S. B. Smith, "College and University Library Cooperation," *Library Quarterly*, XVI (1946), 122-89.

and national service through inter-library loans, the answering of national quests for information, and the creation of nationally useful bibliographic and reference tools. As documentation of increasing masses of library materials becomes more complex, the university library must expect to devote increased amounts of intellectual energy, time, and space to the cooperative solution of regional and national bibliographical problems.

CHAPTER II

PROBLEMS OF POLICY AND ADMINISTRATION

BEFORE any detailed library building program is attempted, the maker must know how his library is to be organized and administered. In particular, he must have arrived at the answers to two fundamental questions, to wit:

a. How big will the collections to be housed beneath this roof finally be (problem of growth)?

b. How will the library be organized? Will it be in the simple pattern of consolidated preparation, consolidated storage, consolidated service? Or will it have divisional, or even departmental, collections, stacks, catalogues, circulation desks, and librarians? And if the decision is for the latter, will the satellites be beneath one roof or several (problem of organization)?

This chapter attempts to comment on the factors which may affect decision on these two vital points. At the end of this chapter we shall discuss the less critical but still important administrative decisions involved in such things as control, heating, what is library material, what is proper storage, what should be the rules for smoking in a realistic contemporary library.

PROBLEM OF GROWTH

The problem of growth in book collections is one of fundamental importance in planning a library building. Yet librarians, architects, scholars, and university administrations have failed to come to grips realistically with this inescapable problem. Two fallacies have been given tacit support through the easy expedient of passing the problem on to succeeding generations. The first is the fallacy of believing that all pertinent books on a given subject, to say nothing of all important books on all important subjects, can be assembled in a single library. The second is the fallacy of believing that library buildings can go on being built, becoming outmoded, and being replaced in ever larger dimensions in order to meet the challenge of growth. No one now seriously supports either of these beliefs. Yet

library buildings continue to be planned, universities continue to make commitments of unknown and unforeseeable responsibility, scholars continue to present their book needs in a way that tacitly supports this fallacy of an impossible completeness. Realism demands a facing of the facts. Library growth has now reached such proportions that the problem cannot be passed on to the next generation with impunity.

Meanwhile our research libraries continue growing, limited only by the size of their budgets and the availability of the materials they seek. Budgets and availability are severe limitations, but an easy dependence on them as a solution to the problem would be both unrealistic and wasteful. Statistics cited by Rider in 1938 to show that research libraries are doubling in size every sixteen years, when extended to 1945, already showed some decline in some areas in the rate of growth which then seemed apparent.

Some of the reasons for this have been stated by Metcalf: "The growth of libraries must slow down partly because of the lack of material to collect—it is impossible to believe that the number of books published will double every sixteen years indefinitely—but it must also slow down because the cost of building construction, of acquisition, of cataloguing, and of service will at some point become so great that they will take more money than is available. The library in a university, for instance, cannot continue to increase its expenses more rapidly than other parts of the university without taking a larger and larger percentage of the total resources, and there is a limit as to how far a library can go in that way without becoming more of a nuisance than a blessing."[1]

Admitting the validity of this argument, it still does not follow that reliance should be placed upon such automatic controls as being wholly desirable. Metcalf referred to *books*, not to the enormously increased acquisitions of documents which libraries have made in larger and larger amount, particularly since the beginning of the late war. Nor should anyone concerned with libraries be complacent about the diminishing proportion of total university expenditures devoted to the pur-

[1] Keyes D. Metcalf, "Division of Fields of Collecting," *College and Research Libraries*, VI (1945), 418.

chase of books, periodicals, and binding. Figures supplied by seven large university libraries[2] showed that such a decline had already begun in 1945. But so long as departments of athletics and grounds and buildings receive a higher proportion of total university expenditures than the library system, on which the whole university function depends, it would be unwise to assume categorically that the proportion devoted to the library is adequate or that it should be fixed and unalterable.

The annual rates of growth, 1938-44, for the same seven libraries had likewise diminished. The total growth of all seven libraries for the seven-year period following 1938 would cause them to double in size every 41 years, more than two and one-half times as long as the sixteen-year figure indicated by Rider's statistics for the period ending in 1938.

Yet this diminishing rate of growth offers no ground for complacency about the problem. American libraries in 1940 held only about two-thirds of the estimated 15,000,000 titles published all over the world to that date.[3] At the same time, they possessed only 37 to 67 per cent of all titles listed in selected world bibliographies.[4] In view of the growing concern among librarians that there should be at least one copy of every significant extant work located in some library in America, no matter where published, and in view of the possibility that such a cooperative activity as the Farmington Plan will seek to bring this about, it is obvious that figures showing diminishing rates of increase should not be accepted too literally. What the libraries of America have already gathered in their collections is far from being what the demands of research require.

Consequently, though budgets and book production will operate to limit acquisitions, they do not, and should not, afford the solution to the problem of building bigger and bigger libraries. Larger budgets should be made available to provide libraries with the facilities and materials demanded by faculties and students. At the same time, librarians and educators

[2] Columbia, Harvard, Illinois, Minnesota, Pennsylvania, Princeton, and Yale.

[3] Robert B. Downs, ed., *Union Catalogs in the United States*, Chicago: American Library Association, 1942, p. 82.

[4] *Ibid.*, pp. 85-88.

should attempt a realistic facing of the consequences of growth. There are several ways in which this might be done.

Specialization Agreements. Continued geometric growth of research libraries can be checked by an avoidance of unnecessary duplication through a division of labor among neighboring institutions. Specialization agreements to this end have already been noted in the previous chapter.[5] Such agreements should be promoted regionally and nationally.

As has also been noted, cooperating libraries should explore the possibility of transferring large blocks of little-used materials to other libraries having similar collections, resulting in more comprehensive collections in one place than would ever be possible in more than one. University administrators, too, should take cognizance of the fact that individual scholars, enthusiastically building up highly specialized collections in one institution after another as they move to higher estates, leave behind them dormant and little-used collections irrelevant to the needs of the institution from which they have departed. It is not unthinkable that budgets could be spared and congested buildings relieved by allowing such a collection to move with the scholar whose enthusiasm and needs were responsible for bringing it together. In order that such developments may approach early and fruitful conclusions, library buildings must make adequate provision for inter-library loan facilities, photo-duplication services, and a flexibility well adapted to losing and gaining large blocks of materials in widely separated subject fields, stack locations, and areas of service.

Optimum Size. What is the optimum size of a library building? Harvard College performed its educational function in 1790 with a total of 12,000 volumes. Today its library system embraces over 5,000,000 volumes and pamphlets. Though its rate of growth has diminished, it could theoretically go on developing, in the next century and a half, to two, three, or twenty times its present size. How many of its five million volumes are actually necessary and useful to its present educational function and how many represent a voluntarily assumed obligation

[5] See above, p. 12.

to the country? Its great medical and law libraries contain vast quantities of books pertaining to the history and philosophy of their disciplines; are these vitally essential to the training by Harvard of practicing lawyers and doctors? Harvard will probably never reach 100,000,000 volumes, and it may be doubted if any other library will. But where should the line logically and properly be drawn? Industry has found that factories can reach such a size as to produce diminishing returns; libraries cannot expect immunity from the inefficiencies of size any more than industry. For the undergraduate it is becoming apparent that a building or a portion of a building housing a relatively small number of volumes is more satisfactory than an immense library of millions of volumes.

If the line is being drawn, and must be drawn, for the undergraduate, is there any valid reason why it cannot be drawn for the advanced scholar? It is to the interest of scholarship itself that the attempt should be made realistically. So long as libraries can assure scholars that materials will be acquired *as needed* through inter-library loans or cheap methods of reproduction, might it not be true that, considering convenience of use and cost of handling, a first-class reference and working library with reading, shelving and work space for 500,000 volumes, or a million volumes, would be fully adequate for the needs of graduate students and faculty? Few scholars can anticipate every need they may encounter in their researches. No librarian has a budget large enough and perhaps no architect could design a building big enough to house, permanently and close at hand, all the materials that would be necessary to anticipate such a need. It would be folly to make the attempt, even if budgets and books for it were available. Yet, as habits and attitudes direct at present, we are still continuing our building of libraries as if we thought we could achieve the unachievable.

It is impossible to be completely foresighted about expansion. Quite aside from the limitations imposed by a frozen architecture, the campus itself, as represented by the site plan, has a restricting influence. In early universities the library occupied a central position, if indeed it was not in the only building. It was so hemmed in by other buildings and so closely in-

vested that it could not be made larger. Subsequently some universities sought to put the library at the end or edge of the campus (always with the rationale, however, that the site would someday be the center). Such a position is to be found at Columbia where the Butler Library was placed on the periphery in precisely the same position with respect to the whole as was assumed for the library at the University of North Carolina or more recently for Princeton University (at the corner) and for Rice Institute (on the axis at the end). Columbia is now discussing plans to drape the Butler Library with new classroom buildings to house the humanities and social sciences. The university library at Chapel Hill (North Carolina) finds itself twenty years later virtually in the center of the campus, if not in the center of the buildings dedicated to intellectual activity. The library at Rice Institute might at the moment be able to extend a mile towards the bayou, but one new building placed between it and the bayou will make the library more central and at the same time limit its potential growth.

Space *will* allow needed additions at Chapel Hill (though a memorial tower behind it may forbid desirable vertical expansion), and space will presumably be available in Houston for years to come; already it is restrictive at Columbia, and only to a degree less in Berkeley. From such facts it has been argued that any institution which still has an open campus should allot to the library an area several times its present size and then actively and continuously protect that area from encroachment by other campus interests. Such a plan, it is averred, will take cognizance of the need for a library-centered campus plan and of the increasing import which the library is said to be assuming in higher education.

Such a conception is not entirely realistic, however reassuring it may be to the contemporaries who express it. It is clearly an oversimplification which does not solve all difficulties. Universities as a rule have not grown vertically and economic considerations are unlikely to change this for existent institutions. If the university grows over the land instead of into the air, and the library remains at the hub, it is clear that with suffi-

cient growth important educational buildings will arise a mile or more from the hub library. Then space as measured by time, space to be traversed at a local rather than an aeronautic scale, will cause the users to demand, probably deserve, and certainly get peripheral library collections or even buildings. It is doubtful that they should be defeated when they make such demands, for the library might take on the Gargantuan aspects of a Pentagon in Washington, get out of scale with the human activities of scholarship, and in point of fact become less efficient than a group of smaller libraries.

An ideal solution might therefore seek an expansible location near the center of the probable educational and residential elements of the campus, preserve this space so as to permit a reasonable but not an elephantine growth, and visualize in the site plan a time when the central building would cease to grow but would become the center of response for a group of ganglion libraries on the periphery. Such a growth would have been arrested deliberately and not because of monumental architecture or lack of land. The time required by the user would have become the predominant factor.

Storage Libraries. A practical example of the time factor may be found in the efficiency possible at a single delivery point. If the average waiting time at the loan desk exceeds ten minutes, it may be wise to establish additional delivery points to relieve the pressure and improve the service. When this happens, it is just as well, and just as efficient, to have separate stacks in separate buildings. Those buildings may be contiguous, as in the Library of Congress and its Annex, or may be widely separated, as in Widener Library at Harvard and the New England Deposit Library across the river. In the Library of Congress all books in the stacks of either building may be delivered at either loan desk, depending on where the reader makes his request. At Harvard the reader may use the collection of the storage library in its own reading room or may request delivery to Widener for his use. In either case the erection of a separate building was the only solution to a difficult problem; expansion of the original building was not possible.

The New England Deposit Library is a cooperative venture

of libraries in the Boston area.[6] At an initial cost of $175,000 for the stack part of the building it was possible in 1941 to erect a simple concrete and brick structure to house shelving equal to 5,500 standard 3′ x 7′ 3″ sections, or for more than a million average-sized volumes. The annual rental was placed at $5.00 per section, ample to cover operating costs, carrying charges, and amortization when all sections are rented. The building is planned and constructed so that additional units of similar size and construction may be added almost indefinitely. Iowa State College and Ohio State University have erected storage libraries of their own of similar economical construction at comparable cost.

The cost of storage represents only part of the actual cost involved in transferring a volume from a central to a storage library. The cost of the necessary change in records is considerable. Because of this, the tendency has been to send to storage long runs of periodicals, government documents, obsolete textbooks, and sets of old encyclopedias which require a lesser cost per volume for record changing. Another means of reducing storage library costs is the expedient adopted by Harvard University of sending some 25 per cent of its current acquisitions directly to storage, after a much more simplified processing than that used for the main collections. Still another method is to transfer whole sections of a classification to storage. Iowa State, for example, has stored all its books still not reclassified from the Dewey Decimal System. Since books can be more economically stored when classified by size, Harvard University has developed a special classification for books sent to storage. It consists of a symbol indicating storage, another symbol indicating volume height, and a number (n) showing that a given book is the *n*th one of that height sent to storage. Such economies are important, but there ought not to be too great concern about the cost of transferring books to storage; for, as proved by the experience of the New England Deposit Library, storage by size in fixed locations with every shelf

[6] Keyes D. Metcalf, "New England Deposit Library," *Library Quarterly*, XII (1942), 622-28; Francis X. Doherty, "The New England Deposit Library: History and Development," *ibid.*, XVIII (1948), 245-54; and "The New England Deposit Library: Organization and Administration," *ibid.*, XIX (1949), 1-18.

filled to capacity is the cheapest form of effective book storage yet devised.

In sending books to be stored in a deposit library, the librarian attempts a distinction between active and inactive material. Within recent years the faculty chairman of the library committee in a large university formally protested against the establishment of a deposit library on the ground that such a distinction could not be made. This no doubt reflected the opinion of a large segment of research library users. Yet those who urge such an argument overlook the inconsistency of their position: their research library itself is a fragmentary selection from the world's book supply of those books which they and their librarians deem necessary. If such a distinction can be drawn in making acquisitions, why cannot a similar distinction be made in meeting the problem of storage? It has in fact been drawn, though perhaps not always to the complete satisfaction of all users, in a number of institutions that have sought relief from overcrowding in deposit libraries. Even in a comparatively small library such as that of the University of Colorado, it has been found that one-third of the collection accounts for more than 90 per cent of the circulation. Certainly as a research library approaches, for example, the million-volume mark, it becomes increasingly practicable to relegate little used materials to a cheaper form of storage than that provided in the main campus library.

It should be noted, however, that storage costs could be reduced still further and other advantages be achieved if the community, or regional, deposit library should become a consolidated library and not a mere warehouse. The renting of sections of a warehouse to participating institutions is wasteful of space and freezes great quantities of books in a form of inactivity worse than that intended. The New England Deposit Library is said to contain more than sixty sets of Gibbon's *Decline and Fall of the Roman Empire*, though most of these are of different editions, not duplicates in the strict sense of the word, and there is a provision whereby real duplicates can be discarded.

This, of course, is a needless expense in storage, particularly when unwanted duplicates could be used for exchange or sale

to other sections of the country. The real future of the deposit library as a challenge to the problem of growth and as a contribution to the cultural resources of the nation seems to lie in a form of organization that will permit greater control by the deposit library over the inactive materials in its custody, regardless of the original ownership.

Planning Future Expansion. Though it is administratively and financially difficult to erect a building to take care of all desirable future expansion, yet it is frequently possible to build partially and to plan the building so that additions can be made. Yet a caveat should be entered. Duke University, the University of North Carolina, and the University of Missouri, to mention only a few instances, are now facing the problem of building additions to structures that were expected to be "expansible." Pyne Library at Princeton in 1898 was thought to conform precisely to Soule's criteria for library planning, particularly in respect to expansibility. Yet three decades later a proposal to expand it was discarded as being undesirable administratively, pedagogically, and otherwise. Seemingly, no generation is willing to build additions to a library structure erected according to the ideas of planning entertained by its predecessor. The reason is obvious: the programs of education, the needs and techniques of research, and the methods of librarianship change so rapidly as to accelerate the rate of obsolescence of library buildings planned on the assumption that an earlier generation can anticipate what a later generation will desire or need. "The minimum requirement should be that the architect provide a fully developed scheme for the ultimate building as well as for the part which is to be currently built. Vague dotted lines indicating that various elements *might* be expanded this way or that simply will not do. The expanded building must be known to be workable; it is this expanded building and not what is presently to be created which must be established in the minds of administration and of building and grounds committees as the actual building. Otherwise, when the expansion is needed, it may be found that it is architecturally not so possible as the dotted lines had suggested, or will cost too much, or is physically impossible because other

buildings, built in the interim, have defeated the original purpose."[7]

Expansion of an existing building may occur either horizontally or vertically. Vertical expansion must be planned in advance so that foundations and supporting columns may be made strong enough to carry the superstructure when it is added. Stack units of the multi-tiered variety have frequently been so designed. Administrative experience with the first portion of a building, however, frequently changes the librarian's ideas about the planned addition. At the University of Texas, for example, we find the librarian (who was, it should be added, not responsible for the original plan) recommending the filling in of light-wells with stacks in preference to using the upper floors of the tower which were designed for stack purposes.[8]

Horizontal expansion of stack and reading space is more generally favored or found necessary because of lack of adequate foundations for vertical additions, architectural inhibitions against additional height on a given site, or the librarian's desire to place as many functions as possible on a single level. The most usual difficulty lies in expanding both stack and reading space so as to retain effective administrative relationships between them. Expansion plans of the University of Illinois allow for parallel additions to stack and reading areas but will result ultimately in having the stack entirely enclosed in the center of the building. For the new libraries at Iowa and Princeton, where stacks and reading areas are planned as integrated units, expansion will involve only a provision of more of the same kind of building.

Expansion, particularly of book storage, may go underground in areas adjacent to the library building. Such expansion is being planned as the only possible way of increasing the storage capacity of the Widener Library, it being estimated that space for 2,000,000 volumes can be so provided no farther away from central control than some locations in the present building. Underground stacks are included in the

[7] John E. Burchard, "Postwar Library Building," *College and Research Libraries*, VII (1946), 118-26.

[8] Donald Coney, *The University Libraries: Plans for the Next Twenty Years* (n.p.n.d., mimeographed), p. 2.

new Princeton Library, even though the northern side has complete fenestration. With modern illumination and air-conditioning, objection to such underground provision for book storage or reading areas is largely limited to psychological considerations and to the increased expenditure for electrical power.

Reference and Selection. As libraries grow larger, the problem of reference and the selection of relevant material becomes more difficult. The conventional tools of card catalogue, indexes, and bibliographies become more and more difficult to use, even when it is assumed they afford complete access to all relevant material. This assumption is already being seriously challenged in the scientific disciplines. It is alleged with increasing frequency that the volume of scientific publication is growing at an alarming rate, that soon, if it has not already happened, it will become impossible for the creative scholar to maintain necessary contact with his fellow workers. The situation with regard to the humanities and social sciences is even more desperate, and promises to become much worse before a major and revolutionary solution is sought.

The difficulties are many and cumulative. Enumerated, they include (1) lag in publication after completion of research (the federal government alone has many thousands of research studies locked in its files for lack of publication funds; many learned journals have large backlogs of unpublished material); (2) lag in listing and indexing of material, or lack of such listing and indexing entirely; (3) delay in acquisition by libraries; (4) delay in cataloguing by libraries or lack of sufficient cataloguing. All of these conspire to keep even the diligent scholar away from material which might be useful to him.

Bibliographical Service. Few large libraries are today equipped to give full and efficient bibliographical service. They are generally not prepared to go beyond the compilation of short selected bibliographies for general or specific needs. Beyond that the inquiring reader is commonly referred to a card catalogue or left to delve alone among the footnotes of books and reference works immediately available. Notable exceptions are the Legislative Reference Service of the Library of Con-

gress and the special abstracting and indexing services offered by a number of special libraries.

At the Bell Telephone Laboratories, for example, every research man receives regularly an analysis of the scientific literature in all languages that may have a bearing on the problems of Bell. From the Library of Congress any legislator may request the performance of bibliographic research and the analysis of any subject matter bearing on current legislation. The cost of such library service is great, but properly organized and supported it could be supplied to any discipline.

Confronted with problems of such magnitude, it is small wonder that librarians look with hope to the magic of contemporary applied science. Ahead of them beckon the lights of microfilm, microcards, facsimile reproduction at high speed, television, rapid selectors, and numerous other possible applications of present-day engineering. It is clear that the potentials of these techniques are such as to give pause in the planning of a library to be built today and expected to be of service for the next several decades. Nonetheless, the situation has not crystallized to the point where any library administrator is prepared to stake all on the assumption that any one or any combination of these possibilities will be realized in the near future. In short, the problem for the designer of a library to be built in the next five years is one of planning a building which will suffice if we are limited to the pedestrian resources of present-day practice and yet one which will not prevent a rapid shift from this practice to take advantage of all the enticing potentialities of the new instruments. This problem is not so difficult as it may seem. The new instruments will without exception require less space than the present ones; they will require a greater amount of power and other similar services; the problem as it appears at present is simply one of not letting the permanent architecture inhibit progress. It is hard to see how the original Library of Congress or the approaches to the Boston Public Library could be made to fit the use of such machines, but it is easier to visualize them in the Annex to the former. Fortunately the day when sermons on this subject were necessary seems almost to have passed. The doctrine of flexibility will suffice to accommodate even the quite revo-

lutionary changes in librarianship without crippling the library if optimism about these devices proves ill-founded.

PROBLEMS OF ORGANIZATION

Subject versus Form. The service and storage functions of large university libraries have shown a tendency to divide into a number of separate departments based on the form of material. Periodicals, documents, manuscripts, pamphlets, microfilms, music scores, records, prints, and rare books have all on occasion been embodied in separate departments of varying importance, leaving to the central collection only those materials conceived to be ordinary books. The serious subject-approach to knowledge has been hampered by the growth of these departments, however desirable they may have seemed, and the scholar has been compelled to go to many places and to many catalogues in order to consult the library's resources in his field.

The planning of a new central library building should be preceded by a careful analysis of this departmentalization by form of material lest a plan of organization be perpetuated in stone before its unwieldiness is recognized. Recently there has emerged a conception of library organization by subject, or divisional, departments of knowledge which would embrace in a single department all pertinent materials whatever their physical form. At Iowa "the 'Heritage' Library will thus become a skeletal outline of human achievements composed of models, maps, pictures, books, posters, phonograph records, slides, objects, moving pictures, etc."[9] The Heritage Library is intended for undergraduates, but it has been suggested that the same concept may be applied in assembling research materials for scholars who may have no greater liking than undergraduates for moving from one department to another in search of the materials which they require. Logical cases can be made out for either kind of organization in a university library, and probably most librarians will end with some compromise between them. What is most important is that the

[9] *The Library as a Teaching Instrument,* Iowa City: University Library Planning Committee, 1945, p. 9.

issue be consciously faced and that a deliberate decision be made before the planning of the building is begun.

Subject versus Division. The issue here is one of departmentalization by subject matter as against departmentalization by lines of university organization. Inasmuch as a "characteristic of research today is that knowledge appears to be growing faster between and among traditional subjects than it is within them,"[10] some universities may have too many "subject" libraries representing the narrow intellectual interests of single academic departments. University library organization seems to be moving toward a broader divisional arrangement of departmental libraries and reading rooms. This is possible because knowledge is unitary and subject lines blur from book to book and within books so that the lines between collections of books tend to be arbitrary. These collections should therefore be as few as the convenience of the university community will allow. For the new library building this may mean planning for divisional rather than departmental reading and service areas—to be so arranged and used when the building is first occupied, if possible, or at any later date, if necessary. Historically, departmental and branch libraries have arisen principally because of the demand of scholars in a particular discipline (and largely in law, architecture, and the natural sciences) that their library materials be physically near to the office, the drafting room, the laboratory. As departments have grown and as the fringes between them have become less clearly defined, problems such as that just posed arise with increased force. But in effect it must be admitted that any trend towards the divisional collection is really a retreat towards centralization as represented now by a sub-center. Indeed, the rapid growth of university facilities and library holdings has made it likely that the divisional sub-center may actually be larger than the original central library from which the hegira occurred.

Thus the old dichotomy is stated anew. The decision must be made between the advantages of contiguity and specialized reference service on the one hand, as provided in the departmental system, and those of better and more frequent contact

[10] *Ibid.*, p. 7.

at the fringes, as implied by the divisional system. The divisional system is doubtless more stimulating for the student and more useful for the visiting scholar (for whom the central system would be still more useful); the departmental system is surely more time-saving if less suggestive for the scholar in residence. Hence, as in most of the important questions raised in this report, the decision will have to be taken locally.

Centralization versus Decentralization. So much recent literature has concerned itself with the arguments for and against centralization that they need not be repeated here.[11] Realistic appraisal of most large university libraries will reveal a usually irrevocable commitment to some form of departmental library system in greater or lesser degree. That being so, the housing of the library program should be planned to place the libraries for the laboratory sciences and analogous fields under the same roof with the scholars who depend upon them.

This will not mean, if the campus building plan is well designed, that there will be a separate departmental library for botany and another for zoology, but rather that there will be a building housing botany and zoology and a library in the field of the biological sciences. The Biology Library in the Life Sciences Building at the University of California, which includes the subject of psychology as well, is an excellent example. The principle of a divisional grouping of subjects is observed, even though the library is not located, and should not be located, in the central library building. However, the degree of decentralization will be very much a function of the scale of operations. The physicist at Rice Institute may actually be able to reach his central library in less time than another physicist in a very large university might be able to reach his particular departmental or divisional library. In these circumstances, a departmental system might be most inefficient for Rice yet essential for such a complex organization as that at Berkeley.

Recent references at Princeton, Iowa, and elsewhere to central library buildings as "laboratories" for the humanities and social sciences represent recognition of an analogous situa-

[11] For a succinct summary, see Wilson and Tauber, *The University Library*, Chicago, 1945, pp. 127-37.

tion in these fields of knowledge. For these non-laboratory disciplines, however, where books and other library resources constitute the "laboratory" materials, good building planning now recognizes that teachers and students must be allowed ample and sufficient working space within the library for effective instruction and research.

Control of the Building. Rigid and overall control of the library building is currently being accomplished with the attended turnstile at a number of large public and university libraries. The turnstile and its attendant will not always be successful in stopping the determined thief, but they will stop the more casual "borrower" of reserve and reference books who finds it more convenient to use the volumes outside the library. Nuisance losses of nearly one thousand books a year were cut to a few dozen upon the installation of turnstiles in Widener Library at Harvard. Similar experience is reported by other turnstile-using institutions, most of which are located in urban centers where a large, heterogeneous, non-resident clientele makes other methods of controlling losses difficult to administer. In general the turnstile or some similar barrier will be more suitable for a library located on a city street than for one in a less populous area or one with a more homogeneous clientele. Statistics on losses are difficult to obtain and not convincing. First-rate opinions still differ as to whether it is preferable to suffer numerous losses and make the library psychologically more approachable or to stop some of the losses and impose a disagreeable barrier. The problem is complicated by the fact that really expensive material is probably stolen only by the deliberate thief, who may appear in any environment, from any social stratum, and who overcomes the turnstile as easily as he passes library doors which have no guard. Libraries which can differentiate through separate buildings between the general education collection and the scholarly collection (as envisaged in the new plans for Harvard) will perhaps remove conspicuous barriers from the former and retain them in the latter where the psychological factor is of less consequence. Libraries which cannot provide such a differentiation will have to face their problem in the light of local conditions.

Assuming that the question of the turnstile has been settled, there remains that of control at the stack entrance. No general agreement seems possible on the question of whether the "open-stack" or the "closed-stack" library is preferred. Loss of books, increased personnel for shelf-reading to avoid misplacing, and increased janitorial work are some of the costs involved in an open-stack library. Some maintain that the pedagogical value of browsing in the stack will justify such increased maintenance. Others hold that the user of the library, especially the beginning student, is overpowered by the immensity of a large stack and that the supposed pedagogical advantages are thus lost through discouragement. It is also plausibly argued that, since no grouping of books can bring together all works on a given subject, too great an encouragement to stack use produces slipshod methods and diminishes the emphasis that should be placed on bibliographies, guides, indexes, etc. Nevertheless, if an open-stack library is decided upon, effective control of the building should be provided. If the building exit is not controlled, some control of the stack exit is necessary. This should be so contrived as to occur normally and naturally to the user and should be easy to administer. Traditionally, it is placed at the circulation desk.

In order to reduce the size of the control staff to a minimum, most control plans are based on a one-point exit from the building, the stack, or other controlled area. But realistic account must be taken of the fire laws, many of which require many more unlocked exits from stack or building than even the most affluent library could afford to control. Planning should seek to keep such emergency exits at a minimum, but there are practical ways in which they can be managed without the necessity of maintaining a guard. Certain psychological factors, such as reasonable regulations, good lighting, and other physical facilities, and the visible presence of a staff member, may be introduced to minimize the problem of control.

Seating Space. The number of seats in the central library building depends much less on the number of books in the library in relation to the number of students on the campus than it does on the total number of study and recreation spaces

on the campus. At the University of California, for example, it is estimated that approximately 80 per cent of the library population at a given hour is using table space for other than genuine library activity. This is not due to the greater attractiveness of library space, but to the inadequacy of any kind of seating space besides classrooms outside the library. Thus a university which approaches the urban in its characteristics must recognize a study-hall function as distinct from its library seating problem. First recognition of this problem has come in certain large universities, with large reserve-book problems, where the reserve-book room and the study room have been placed outside the control, and hence to all intents and purposes outside the library though still under the same roof. An extrapolation of this custom might suggest for the large institution that the study hall be combined with the reserve-book function in a building separate from the central library though located near or adjacent to it. Though it is true that reserve-book and textbook readers have little pragmatic occasion to use the larger library materials or the card catalogue and might therefore be served at the lowest level as well or even better in another building, the challenging question remains whether the invitation to the treasures of the library is not essential; whether greater service at the pedestrian level may not result in a student who never lifts his eyes from the road.

Estimates of needed seating space must take into account the nature of the central collection in relation to departmental and divisional collections housed in other campus buildings. Space need be provided only for the students who are enrolled in departments whose library materials are located in the central library. If figured on this basis, which is more accurate and realistic than using total enrollment, the conventional figure of providing seats for 25 per cent of the total student body might well be changed to 50 per cent of the students in the departments served. Students seated at tables or in carrels require about 25 square feet of space. With more comfortable and informal furniture, this figure might well go up to 40 square feet or more.

Library Materials. "No one will deny that books and written language are the most detailed and explicit means man has

yet found for communicating his thoughts. But there are other graphic records which communicate some aspects of thought more directly, more satisfactorily, than does language in its written form. Slowly libraries are becoming, not depositories for books, but depositories for the graphic record of human thought. . . .

"A list of materials by form will suggest their various physical characteristics which strongly influence the technical processes [and other aspects of library administration].

1. Books, i.e., separates, pamphlets, serials (including newspapers and public documents)
2. Manuscripts, including transcripts
3. Reproductions of these; i.e., photostats, photographs, and microfilm
4. Maps, charts, diagrams (a kind of record presenting certain facts and ideas more accurately and economically than language)
5. Pictures, including reproductions of graphic and plastic arts as well as photographs of people, places, and things
6. Music in its written form (a kind of communication different from language)
7. Music recorded as sound in the forms of phonograph disks and cylinders, and sound film
8. Motion pictures, and language recorded as sound; e.g., the 'talking book' for the blind."[12]

Yet it should be noted that subject groupings of such varied materials, though possible, will probably not be carried out except in relatively small, selected collections for purposes of illustration and instruction. Large collections of materials, because of their nature, will no doubt continue to be grouped according to kind rather than content. Such materials as microfilms, maps, papyri, manuscripts, and rapid-selector devices require not only specialized storage facilities but also the attendance and supervision of specialized personnel. Segregation

[12] Donald Coney, "The Administration of Technical Processes," in C. B. Joeckel, ed., *Current Issues in Library Administration*, Chicago, 1939, p. 167-68.

for the protection and servicing of such collections, grouped according to their nature, should therefore be provided.

Many of these forms of library material must be provided with apparatus for using them, which is also a responsibility of the library and the department in which they are housed. A microfilm without a reader, a motion picture without a projector, a record without a record-player, is not a complete item of library equipment. Libraries must soon be prepared to provide for listening to records or viewing a film in the same manner in which they provide tables for reading. These materials are rapidly passing through their recreational phase to status as pedagogical tools. The library building being planned today must provide for the complete service of these materials, or be found inadequate very soon after possession is taken.

The day is not far distant, indeed is already at hand, when a professor may assign a class the task of viewing certain documentary motion pictures instead of reading so many pages of text. He may very well choose to have this assigned for outside work rather than projecting the film in class. Films, like books, may be expected to be in sufficiently short supply to cause them to be treated as reserve material. An up-to-date library building must therefore provide a number of projection areas for the individual and for the group. Similar adequate provision must be made for the hearing of recordings of music, speech, and other auditory phenomena.

Some question may be raised about the term "object" in the above (p. 27) catalogue of the kinds of library materials to be included in the Heritage Library at Iowa. Most great libraries possess valued objects, related to their collection of more conventional library materials, which reasonably find their place there. The key may be found in the term "related." That is, anything which records or documents human knowledge, or is related to that recording or that documentation, may rightfully be considered as being within the province of the modern university library.

Proper Storage. The well-established convention for storing books involves standing them upright on shelves not more than 3′ or 3′ 6″ long. So long as books retain their dominant place in

our libraries, this convention is not apt to be upset. But the many other forms of library material mentioned above have already caused the creation of special types of equipment to house special materials. Many more special designs for special purposes may be expected during the life of buildings in planning today.

When pamphlet collections do not find their way into specially designed pamphlet boxes or into special bindings—either solution places them on shelves along with books—they are stored in business filing equipment which necessitates a departure from conventional stack ranges on 4′ 6″ centers. Many picture collections are accorded similar treatment. Newspapers, too heavy to wear well while standing on edge, are shelved flat, two volumes to a shelf, in special ranges built on 6′ to 6′ 9″ centers. Such shelving, often fitted with rollers on shelves and uprights, is also needed for other elephantine volumes, such as atlases and art portfolios.

Maps may be stored horizontally or vertically in specially designed equipment which bears no relation to conventional stack arrangements. Phonograph records require specialized treatment which may, however, be easily introduced into the stacks with other library materials. Microfilm may also be handled in specially designed inserts in ordinary library stacks. Motion pictures, because of their inflammable and explosive characteristics when not made on safety film, require special fireproof vaults which will usually take them out of their normal subject relationship to other library materials.

In connection with these special materials a further point needs to be made, one which may be compared with that suggested on p. 33 above. Microfilm, records, motion-picture films, all require tools for their use. The microfilm reader, the pick-up, the projector and screen must be put into action. In these circumstances the greater time spent by the user in getting the actual material from a central specialized collection as compared with that from a divisional collection may well be offset by the better apparatus and more convenient facilities for the use of the materials which may be economically possible only at the central level.

Although only microfilm and motion pictures and rare books

require special attention to atmospheric conditions, all library materials will benefit from an air-conditioning system which provides pure, dust-free air, without too great fluctuations of temperature and with humidity of 40 to 50 per cent. Proper storage is in large measure a matter of maintaining these ideal conditions. Losses without such provision will be costly (see Chapter V).

Smoking. Smoking is a part of the working habit of many people, and is very common among students and scholars. It is a nervous habit which becomes a necessary adjunct to work and study and has little if anything to do with recreation. Thus the library which seeks to solve the problem by providing a place where its clientele may go to smoke may only be hampering work in progress by forcing an unnecessary and unwanted break. The provision of special smoking lounges may localize and restrict the smoking areas in the library but may not be the satisfactory solution for the smoking worker.

For every smoker who will in the middle of a piece of work move to a smoking lounge when he feels like smoking, there are probably several who would prefer not to use the library under such conditions. Some will forego smoking and work in the library; others will try to move their books and work to other places where smoking is possible. The solution may lie in providing (1) rooms for people who object to smoke, and (2) areas where smoking cannot be tolerated for hazard reasons, and then allowing smoking everywhere else in the building.

Good and sufficient reasons may, however, be found for prohibiting smoking almost entirely in certain libraries under certain conditions. Air-conditioned buildings must be designed to carry the additional load of smoke, if smoking in the building is desired. If they are not so designed, it may not be possible to tolerate smoking because of increasing staleness of air over the entire structure. Buildings or areas completely air-conditioned for the preservation of materials, such as the Houghton Library at Harvard University, may bar smoking entirely because of the deleterious effect of smoke and ashes.

Generalization of the problem for all libraries is difficult, but it seems certain that some provision must be made in nearly

all libraries for smoking in some areas. These might be reading areas, which would allow use of reference and other non-circulating materials while smoking, or rooms outside the general reading areas, which would limit their use to students using circulating materials. Smoking should usually also be permitted in studies, seminars, offices, and conference rooms. If permitted in carrels, whether located within or without the stack, there will be an additional burden placed upon the janitorial staff.

CHAPTER III

DESIRABLE SPACE ARRANGEMENTS

Main Floor. Just as the planning of a library building must begin from the inside, so must the planning of the interior begin with the main floor, the most used area in the library. It is best located at the level of the principal entrance so that as much library business as possible may be conducted without recourse to stairs or elevators. In so far as the site permits, other floors should be so located both above and below this level that vertical distances to be traversed from the main floor to other parts of the building will be kept at a minimum.

Ideally, almost all library functions should find their place on the main floor. Departures from this rule which are forced by limitations of space will vary from library to library, depending on which functions are in heaviest demand. The arrangement of space upon the main floor also will depend upon similar considerations. Whether circulation desk or reserve-book room should be nearest the entrance will depend on which point of service draws the most patrons.[1] In what follows an attempt is made to establish a preferred pattern from which local conditions will naturally require deviations. Such variations, however, should be made consciously and deliberately, with full cognizance of their effect on the operation of the library.

Public Catalogue. The public catalogue merits a prominent place not far from the main entrance. As the key to the use of the library it should also be immediately available to the circulation desk, the bibliographical and reference facilities, and the processing departments. Admittedly this may be difficult, but the efficient operation of the library depends in no small degree on having the catalogue within easy reach of readers and of the staff who use it frequently.

[1] H. V. Gaskill, R. M. Dunbar, and C. H. Brown, "An Analytical Study of the Use of a College Library," *Library Quarterly*, IV (1934), 564-87.

All catalogue cases should be free-standing and should be so arranged as to make it possible to consult all parts of the alphabet with a minimum of movement. Built-in wall cases, or even free-standing cases arranged along walls, are as a rule to be avoided, since distances are likely to be increased and serious obstacles placed in the way of expansion. Standing-height tables (42") between catalogue cases are preferable to shelves incorporated in the cases, and some high stools should be provided for readers making extended use of the catalogue.

How much space is required for the catalogue and to provide adequately for future expansion? The question is difficult to answer. Traditionally the subject has been discussed in terms of an assumed ratio between number of volumes and number of catalogue cards. This is not surprising since library statistics have commonly been expressed in volumes. But such statistics may at this point be very misleading. A collection of one million volumes might in some cases represent no more than a quarter of a million bibliographical entities, or titles—if, for example, there were a large number of duplicate copies or many long runs of periodicals. Or, on the other hand, it might contain as many as three-quarters of a million titles—as might well be the case if there were few duplicates and a small percentage of periodicals. A more secure basis of calculation is surely to be found in statistics as to the number of titles. It is believed that in most large research libraries the average number of catalogue cards per title lies somewhere in the neighborhood of four. It may therefore be calculated that in most cases a collection of a half million titles will require a catalogue of approximately two million cards. If we make an allowance for "tie-in" cards and for a future expansion which will avoid too frequent reshifting of trays, we ought not to count on placing more than 800 cards in a tray. On this basis it is apparent that 2,500 trays should be provided to accommodate a catalogue of two million cards, for a collection of a half million titles. The necessary space which must be left between and around catalogue cases for the convenience of users of the catalogue is likely to vary with circumstances and between one institution and another. In general it may be said that if comfortable circulation is to be provided, and if there are to be adequate standing-height tables

between or alongside of catalogue cases, this additional space will vary between five and seven times that actually required for the catalogue cases. If therefore we assume that cases for 2,500 trays will require 230 square feet of floor space, then we must add for the convenient use of the catalogue something between 1,150 and 1,610 square feet, making a total of 1,380 to 1,840 square feet. In addition, allowance must be made for probable future expansion. Libraries have frequently been erected without adequate space being provided for the growth of the catalogue. It is known, for example, that the University of Michigan seriously underestimated the growth of its collections and that the library has been, and still is, badly cramped for catalogue space.

The above calculations are based on a standard 16″ tray loosely filled with approximately 800 cards. If catalogue space will permit, the lowest tray should be not less than 18 inches above the floor, thereby requiring a minimum of stooping, and the highest tray should not be more than five feet from the floor, thereby permitting convenient consultation by users of average height. Catalogue cases which are only ten trays high mitigate the irksome crowding which is frequently encountered in catalogue areas. Yet it should be observed that in a very large library, such as that at Harvard, with catalogues which may soon contain 10,000,000 cards, such an ideally spacious arrangement may not be practicable, and cases more than ten trays high may be necessary. However, this may not be such a serious handicap as it seems, for it is evident that the larger a catalogue is the less will be the traffic within it in any one place.

Circulation Desk and Lobby. The circulation lobby is an area where the user may quickly and comfortably enter his request for material, wait for its delivery, and scan it to make sure it suits his need. Its desk is the focal point of the library from which the user may easily be directed to the stack, the reference room, the reading rooms, or to special departments of the library. Space behind the desk must be provided for the department head and clerical assistants, including typists. If use of the stack is restricted, control of the stack entrance may conveniently be provided here. A signaling system is desirable

in large libraries to notify waiting users when their material is ready. Seating space should be provided for those waiting, as well as for those wishing to scan material before withdrawing it from the library.

Behind the desk ample provision must also be made for the apparatus and records of circulation, for shelving books awaiting delivery, for the efficient checking in of returned books, and for their shelving while awaiting return to the stack. This space deserves emphasis, for it is easy to underestimate the amount needed. Work space should not be cramped and allowance must be made for a peak complement of personnel and for the easy movement of book trucks. A special sorting area for the temporary shelving of books according to their stack locations will save much rehandling. It should be located conveniently to accommodate returned books, and also new acquisitions on their way from the processing departments to the stack.

Necessarily located near the public catalogue, the circulation desk must also be in close connection with the stack, either horizontally or vertically. Work performed at the desk may vary greatly, from the busy routine of circulating books in a large centralized library to the extensive guidance to general reading in a library where most of the circulation work is done through divisional reading rooms. Its size and functions are determined by the type of organization of the library, by the number of other points of service which exist, and by study habits which may depend upon locally prevailing methods of teaching.

Bibliography Room. As the public catalogue is the key to books in a particular library, so bibliography is the key to books wherever located. It is evident, therefore, that these complementary tools should be juxtaposed. Bibliographical collections must also be conveniently accessible to the reference room, to the processing departments, and to the public. Since union catalogues, national and trade book lists, and general bibliography are so constantly used by cataloguers, many libraries in the past have located these essential bibliographical tools in or near the processing departments, thus making them more or less inaccessible to the public. The new Princeton

library solves this problem by placing the public catalogue, the union catalogue, and the bibliographical collections in an ample space on the main floor, directly ahead of the library entrance and immediately adjacent to the reference room, the cataloguing area, and the circulation desk. The amount of space needed for bibliographical collections will depend upon the plan of organization of the library. Separate subject divisions will draw unto themselves many bibliographical aids which would be centrally shelved in a library not so organized.

If planned with imagination, the bibliography room could become a dramatic force in teaching and research. It should be thought of as the nexus between one library and all libraries, the indispensable connection between a fragment and its whole. The plan of its shelving should be simple and easily comprehended. Ideally, though it is doubtful whether the ideal could ever be realized, its plan should be that of a wheel, with the hub representing general bibliography and the spokes representing the various branches of knowledge. An arrangement of alcoves might approximate such an ideal plan. Tables and chairs should be provided. The increasing use of microfilm and microprint for bibliographical tools indicates that provision should be made for accommodating these devices. Office space where librarians and typists might carry on bibliographical work without disturbance to themselves or others is also a desideratum.

Reference Room. The size of the reference room will depend on the organizational plan of the library and the existence or non-existence of other places for reading. Divisional reading rooms will accommodate the reference books of their respective fields and leave a much smaller collection for the general reference room. Similarly, a large general reading room will accommodate non-reference readers, and make it unnecessary to provide reference room seats for more than those actually using reference material.

Whether large or small, the place where the general bibliographical and reference books are kept should be near the public catalogue, the circulation desk, and the processing departments, so that readers and staff may have these comple-

mentary services close at hand. It should also be in reasonable proximity to the periodical and newspaper collections, if they are segregated, so that periodicals may be easily used in connection with other reference books. The reference room should have an enclosed and sound-proof office space for the reference librarians and stenographic staff, in addition to an attractive and conveniently located service desk. Such a space serves two not entirely compatible functions. On the one hand it permits the reference librarian to answer telephone inquiries and to use the typewriter without disturbing the peace of the reference room. If this is the sole purpose for which the closed-in space is required, the walls should be transparent so that the reference librarian will be visibly available to the visitor who seeks to consult him in person. Sometimes, however, the reference librarian may need seclusion in order to pursue a difficult search without interruption. For such a purpose "the goldfish bowl" will not serve and the walls should be opaque. As in many other things, the large libraries may here enjoy an advantage, for they can support both types of activities through the diversification of personnel and the space which they afford; the smaller library should probably rate the availability and visibility of the reference librarian higher than protecting him from the current client in order that he may work uninterruptedly for someone else.

Periodical Room. When a separate periodical room is provided, it is preferably located adjacent to and in connection with the reference room. If both bound files and current issues are to be consulted in it, it should have convenient access to the stack, especially if periodicals are classified together. Providing sound-proof typewriter booths nearby will often forestall requests to borrow non-circulating items for use outside the building and add greatly to the convenience of administration. The size of the periodical room will vary in accordance with the organization of the library. In a centralized system the periodical room will necessarily be large; but in a decentralized system divisional reading rooms and departmental libraries may well draw off many specialized periodicals, leaving only the general ones and the necessary duplicates to be

housed in a central collection. Indeed, though the periodical room is still to be met with in most university libraries, it should be noted that it is not universal and that if a library is fully organized on a subject basis it logically loses much of its justification, for most periodicals will then be distributed and shelved in accordance with their subject interest along with other books, and the undistributable remainder of general periodicals will shrink to small proportions and may well be provided for in a small section of the general reference room.

Reading Rooms. The reference and periodical rooms will provide seats for a certain number of readers, but other more general reading areas must be provided as well. The large main reading room with monumental features, so common in libraries erected in the early decades of the twentieth century, is apparently losing popularity in favor of smaller and more numerous departmental and divisional reading rooms, not all of which can be accorded main floor locations.

If the principle of flexible construction advocated elsewhere in this report is adopted, any floor of the library may be devoted almost entirely to free-standing book stacks, almost entirely to reading and service areas, or to a combination of the two in varying proportions. With movable free-standing stacks and with movable steel partitions, all interior arrangements need be regarded as permanent only as long as they serve their function well. When new arrangements are needed or desired they may be made with little or no disruption of normal library service.

When it is provided, the large main reading room must find a place somewhere near the public catalogue and circulation desk, so that books drawn from the stacks may be conveniently read in the library. Divisional reading rooms will almost necessarily be located on two or more floors. An effort should be made to locate the most heavily used divisional reading rooms on the main floor, in order to provide convenient horizontal access for as many library users as possible. The reserve-book room, if its functions are not absorbed by divisional reading rooms, should find its place on the same competitive basis. In large libraries not divisionally organized, it should be placed

so that its usually heavy and single-minded traffic causes least disturbance to other users of the building. This frequently means a lower floor with a separate entrance.

Processing Departments. Because order work and cataloguing require constant use of the public catalogue, bibliographies, and reference books, these activities should also find space near them. While cataloguing demands space on the same level with the public catalogue, there is some opinion which would place the order department beneath the cataloguing department, especially if pressure for main floor space is great. With good communication via stair and elevator, this vertical arrangement should prove satisfactory. It is desirable that the receiving room be adjacent to the order department, either vertically or horizontally, and this consideration may have a bearing on the latter's location.

The architect who succeeds in creating an effective operating arrangement of all, or nearly all, of the above functions on the main floor will probably find space for only incidental and wall shelving of books on that floor. Although large portions of other floors will then be devoted to book storage, other reading and work areas must find place there as well. Some such areas will be located there because their accessibility is of less importance; others will find their best location there because of the advantage of working directly with books in the stacks.

Seminars. It is a custom of long standing to provide university libraries with seminar rooms to be used in connection with graduate instruction and research. While there are differences of local practice from one institution to another, it may perhaps be said that, following well-known German practice, seminars have traditionally been large enough to accommodate from a dozen to perhaps thirty persons seated around a long table and that their walls have been lined with open-shelf bookcases filled with a collection of sources and reference books and advanced treatises germane to the subject interest to which a particular seminar is assigned. However, there is clear evidence of the declining popularity of the traditional seminar. In some institutions the meetings of graduate classes have very largely been taken out of the seminars and they have been left with

their collections as convenient places of study and research for graduate students. In other cases the books have been removed, though the seminars continue to be used for the holding of graduate classes. The difficulty is obviously that there is a certain incompatibility between the two functions. When classes are being held in the midst of a seminar collection, the room is rendered useless as a place for undisturbed study and research. This incompatibility has led to a proposal in at least one institution to segregate the two functions by arranging seminars in groups of three, the middle room of which will be sound-proofed and will be used for classes and conferences while the rooms on each side of it will be used for the shelving of seminar collections and as undisturbed places of study. Wise planning at this point will surely have to take account of local conditions and custom and to provide if possible for changes as local habits change.

Studies. Though an accepted body of doctrine is lacking on the subject, considerable space has been devoted in some university libraries to studies. Intended for the use of mature students and members of the faculty engaged in research, they are as a rule considerably larger than carrels designed for the use of graduate students. Those in the Library of Congress Annex, which are generally considered satisfactory, are 8′ x 11′, or 88 square feet in area. With readily movable partitions a library may occasionally wish to combine two studies into a larger room for the use of the director of a research project, as the editorial office of a learned journal, or as the office of a library fellow engaged in a special project. Though such library studies have generally been popular with faculty members, they have sometimes proved difficult for librarians to administer; and resistance to them is sometimes encountered, based upon the theory that it is never possible to provide enough to accommodate more than a favored minority. There is fairly general agreement that faculty offices (as contrasted with studies) in the library are to be avoided.

Carrels. Varying in size from 12 square feet to 30 square feet, or more, carrels may traditionally be placed along the periphery of the library stack so as to provide outside light, or,

in accordance with some more recent practice, may be built into the interior of the stack. Unless peripheral carrels are provided with individual windows, the advantage of their outside location is lost in a large percentage of the cases. And the provision of individual windows has the double disadvantage of causing an undesirable architectural effect and of making façades so designed difficult to adapt to other uses.

A solution has been found at Princeton by placing all carrels in the interior of the building. Any bay in the stack area may, though with some waste of space, be fitted with ten single (4′ 6″ square) or double (4′ 6″ x 6′ 6″) carrels, each equipped with an individual ceiling light, reading lamp, desk shelf, bookshelves, chair, typewriter stand, and sliding door with lock. The Princeton bay (18′ x 25′) is well adapted in size for standard book stacks, for seminars, or for subdivision into offices; but it may not be the most suitable size for carrels. Arrangement of single carrels along the long sides of the module leaves a corridor of 9′ in the center. Such space is too ample for a corridor and too narrow for book stacks, hence uneconomical in a central campus library where space is always at a premium. However, it is possible to run the carrel units parallel to the shorter side of the bay and so increase the number of carrels per unit, though this is thought undesirable by some.

The number of carrels required will vary from one institution to another, depending on such factors as enrollment, proportion of graduate students, availability of other kinds of study space, and methods of instruction. Demand in almost all cases has exceeded supply; but it is to be noted that when a carrel is assigned for a considerable period, say for a term or a year, to a single student it is likely to be in actual use for less than one third of the hours during which the library is open. This raises a question as to the advisability of exclusive assignments except in special cases. If convenient shelving for the books with which a student is working can be individually assigned at or near the carrels, then it should be possible for a group of carrels to serve, without serious inconvenience, for a group of students two or three times their number. This could be accomplished at Princeton, for example, in the plan described in the previous paragraph, by providing low-standing

individual bookcases down the center of the 9′ aisle between two rows of carrels in a single bay.

Oases. These units of space are introduced as occasional open areas in the interior of the stack at Princeton, owing to the immense area covered by the stack floor. It is felt that a stack floor measuring approximately 350′ by 225′ would present a formidable and regimented appearance. Hence "oases" of color and comfortable furnishings are planned to relieve the monotony of tier on tier of steel stacks. These areas are planned as open spaces created by omitting one or more ranges of shelving, or as three-sided alcoves, containing easy chairs, tables, floor lamps, and wall decorations. This amounts to breaking a fairly large reading room into fragments and scattering these fragments throughout the stack in order to facilitate browsing and examination of nearby materials. Their constant use in the open-stack library at Princeton has fully justified the experiment.

SPECIAL PUBLIC FACILITIES

In addition to the general, heavily used public accommodations desirably located on the main floor and those which usually find their place in the library stack, a large and increasing number of special facilities must be provided in the modern library building. Their size will depend in each library on intelligent estimates of probable use, and their location must be planned in relation to other facilities which may or must be used at the same time.

Exhibition Areas. The effective display of many forms of exhibition materials, designed to stimulate new interests in books or presented for their cultural value, calls for special planning in various parts of the building. Such areas should provide facilities for the larger and more formal exhibitions as well as numerous small installations for the informal display of special books and related objects. An important exhibition area, desirably located on the main floor and accessible to heavy traffic, should offer maximum flexibility in arrangement and selection of material, ranging from pictures and sculpture to craft objects. Special attention should be paid to lighting.

Such an area, however, will occupy much precious space, and it should be noted that while it is very fitting for a library, an exhibition gallery is not necessary if adequate provision for this function is provided elsewhere on campus.

In corridors and in special rooms, space should be allocated to small exhibition cases, some flat and some upright, some perhaps set within walls, for individual displays of smaller units of book and manuscript materials, accompanied by colorful objects of related interest. Such cases should be illuminated by hidden fixtures.

Special Collections. Suitable shelving and reading areas for special collections may be created in the stacks by means of steel partitions or wire grills, with each collection taking no more space than is actually needed. Second or third floor locations are preferable, but space may in some instances be found on the main floor. "The Treasure Room," for example, may be placed on the main floor if that seems desirable, or several rooms may be located on several floors to house the treasures in the various divisional fields. It is nevertheless true that centralization of treasure-room rarities and facilities provides a maximum of supervision and protection at a minimum of cost. A treasure room requires constant attendance when open, special forms of protection such as burglar and fire alarms, and full air-conditioning.

It is necessary to distinguish between special collections which are segregated for reasons of protection, and those which are segregated for reasons of use. The two cannot usually be effectively combined. The treasure room, or rare-book room, by its very name places a barrier between the reader and the book which is accepted for the sake of its preservation. Such a room may include a considerable number of display cases, for it embraces a museum function in addition to its other responsibilities. Other special collections, such as a collection on the theatre, may be segregated in special rooms or enclosures for added convenience to the users of their contents, but such materials would still be available for general library use through central control. Location of special collections of this kind

should depend on proximity to related materials likely to be used in conjunction with them.

Browsing Room. Whether it is dignified, or degraded, by the name of Browsing Room, most university libraries have need for a popular reading collection—a small public library service for the library's clientele. University people are inveterate readers and turn naturally to reading as a recreational activity. Their recreational reading is likely to be at a fairly high intellectual level. It is therefore possible to exploit for recreational purposes many books acquired by the library for scholarly purposes. With the expenditure of a comparatively small amount of money for light reading and by culling other appropriate materials out of the stacks, a quite satisfactory recreational reading collection can be brought together. It must be open-shelf to be well used, and should be comfortably furnished for casual reading. It deserves a place on the main floor, as near to the main line of traffic as other more primary functions permit.

Lounges. Lounges will be desirable in most contemporary library buildings even if the library administration adopts the most liberal attitude towards conversation and smoking in the library.[2] If the attitude towards smoking is restrictive then smoking lounges will be needed on every stack level in any library of appreciable size. Some librarians have sought to discourage smoking anywhere in the building by making the smoking lounges aseptic and uncomfortable; others think they should be attractive and comfortable. Such lounges may or may not contain books of their own, and may, in some instances, be embellished by changing displays of arts, crafts, or library material.

The library may wish to have a music lounge where records may be played at leisure for the listening pleasure of small groups; indeed where a collection of serious recorded music is available such a lounge will preferably be housed with the collection in the library rather than, say, in a student union. Where the institution has a good-sized and energetic music department, one large enough to warrant a departmental music

[2] See the discussion of this subject above, Chap. II, pp. 86-87.

collection, such a department may properly argue that both the records and the listening lounge should be in the music building. To this the library can properly agree wherever the department is prepared to assume and discharge full responsibility for maintenance of the record collection, or where the holdings are large enough, so that the library can afford to assign personnel to such a purpose, outside the library building.

Almost regardless of other provisions on the campus, the library should have another such lounge, somewhat larger than the foregoing, with easy and undisturbing separate public access. Such a lounge should be arranged to permit free use at any time for lectures or chamber music without interfering with any of the study activities of the library. The room should be carefully studied for acoustics and be planned so that speakers or performers can be easily seen or heard from all audience positions. The environment of this room should be one in which a friend talks to a somewhat larger than usual group of neighbors or fellow club members. There may be an adjacent, well-equipped, modern galley to permit serving tea or light refreshments either by staff or caterer.

Controlled Sound Rooms. If the library is to be kept quiet for those who read in it, provision must be made throughout the building for sound-proof rooms in which recorded music or speech may be heard and in which typewriters and other noisy machinery may be used. An occasional seminar room may be equipped for the study of records and motion pictures. Faculty studies and some if not all of the carrels should be acoustically treated for typewriter use. Other noisy machinery will need to be provided for. Mechanical record-keeping, cataloguing, and circulation systems, some of which are already in operation in American libraries, demand conveniently placed, sound-proof locations for their effective use.

Archives. Most libraries will sooner or later undertake archival functions for their own institutions, if not indeed for considerably larger areas of responsibility. Careful provision must be made for the adequate housing and handling of this material. Precise temperature and humidity control, together with air free of dust and other impurities such as sulphur dioxide,

must be provided in this area even though the remainder of the building is not furnished with so elaborate an air-conditioning system. Viewed solely as historical source material, the archives need not necessarily be located with any consideration of general public convenience; in fact from this single viewpoint they might appropriately be placed in the least accessible part of the library.

However, it must be remembered that many, if indeed not most, university archives owe their origin and the bulk of their current support to the financial savings they offer university administrations in the custody and handling of current or almost current business records. Such service cannot be pursued effectively in Olympian remoteness; before consigning the archives to the top of the stacks the architect should be sure of the exact place they serve in the daily life of the institution.

SPECIAL STAFF FACILITIES

Staff Lounge. Since other rooms provide for receptions and other analogous social functions, the staff lounge should be attractively contrived for the rest and recreation of the staff alone. Under some local conditions there may well be demand for a lounge for each sex, but the better opinion seems to favor a combined lounge for the whole staff with separate retiring rooms, toilets, and lockers conveniently adjacent to it. The lounge should also be equipped with a small galley from which food may be prepared and served. The staff lounge may be located anywhere in the building, but consideration should be given to the possibilities of adjoining outdoor recreation either at ground level or at the top of the building.

Receiving and Shipping Room. This should, if possible, be located at the level of delivery and adjacent, either horizontally or vertically, to the acquisitions department. If it is vertically adjacent, a lift must be provided to carry materials up and down. Where the rate of acquisitions is extraordinarily high, an outside entrance may enclose a loading platform at truck floor height and an area large enough to permit the locking of a loaded truck inside the building. A ramp on which boxes must be moved up and down is to be avoided. If the situation should require a ramp, it should be located outside the

building and take the form of an inclined driveway on which trucks can be driven up and down. Attention must be given to the problem of fumigation; if it should be deemed necessary, it should be handled in connection with the receiving and shipping room.

Stock and Supply Room. This may well have a basement location. It should if possible be adjacent to the receiving room in order to minimize the movement of heavy materials after receipt. It should be equipped with appropriately designed bins, shelves, and cupboards, and should include a desk or office for the supply clerk.

Bindery and Repair Room. This also is desirably located in the basement, especially because of the weight of the machinery with which it will be equipped. Even though it is not presently contemplated that binding will be done in the library, the room should be large enough to allow the installation of binding equipment, if that later seems desirable. Ample shelving for work in progress must be provided, and direct access, vertical or horizontal, to the preparation department is desirable.

Reproduction Laboratory. The modern library must provide facilities for the reproduction of library materials for interlibrary loan and other purposes. Usually equipment for both microfilm and photostat copying will be desired. The planning and location of such a laboratory constitute a task which calls for the advice of a technical expert. Good examples of such installations are to be found in the University of Chicago Library and in the new libraries at M.I.T. and Princeton.

SUMMARY

The foregoing outline of the space requirements and arrangements in a modern university library building is meant to be precisely that: an outline. Its application in specific library situations will be subject to major and minor variations in accordance with local conditions, needs, and habits of library use. Even so, several primary principles remain. The main floor should be at or near grade level and should include

as many as possible of the heavily used departments of the library. Their arrangement should be based on a careful study of their inter-relationships, of the flow of work, of staff and reader traffic, so that the physical effort of extracting needed information and assistance from the library's collections may be kept at a minimum for clientele and staff. Even the most foresighted of librarians and architects, however, cannot anticipate all the permutations and combinations of need which will occur in the life of a building. The only hope of erecting a building which will continue to be satisfactory is to provide for as much flexibility as modern construction methods permit. This principle of flexibility should apply not only to the interior of the building, but also to its exterior; for the building should be so designed and located that its expansion may occur easily and with full provision for the reorganization of interior space in as efficient a working unit as before.

CHAPTER IV

STACK ARRANGEMENT AND CONSTRUCTION

CONTEMPORARY library planning places chief emphasis on the relation between the book stack and the reading areas. This primary emphasis is logical. Since the library exists to make books accessible to users of books, the decision as to the relation between the area where books are stored and the area where books are read is basic. Rigid segregation of readers and book stacks, though generally practiced in Europe and in certain types of American libraries, seems to be giving way to a philosophy of library use which calls for greater ease of access to books and for an intermingling of reader and book space. The proximity of technical processes to each other, to the public catalogue, and to the trade and general reference books is an important but secondary consideration. The philosophy of book use which determines whether book and reader areas are to be segregated or intermingled or juxtaposed will also, in large part, determine the character of the building.

Location of Stack. Five general variations of stack location in existing and projected library buildings may be identified: (1) rear location in an "H," "T," or "U" shaped building; (2) center location; (3) vertical location; (4) peripheral location; and (5) divisional or compartmentalized location.[1] In the formal organization of recent university libraries built before the more informal thinking which has characterized the plans placed before the Committee, the stack has generally been at the rear of the building. It was usually placed there on the theory that stacks must have an abundance of natural light as well as room for expansion; some college and university libraries have retained that location on the ground that natural light is supposedly needed for carrels. One main variant of this general type has the reading room across the front of the building, separated by a delivery hall from the stack at the rear. The entire depth of stack juts out from the building, the whole of

[1] See illustrations on page following p. 142.

which has the general outline of the letter "T." The Watson Library at the University of Kansas, the Library of the University of North Carolina, and King's College Library, Newcastle-upon-Tyne, are good examples of this type.

Another variant retains the rear stack with delivery hall in front, but places the reading rooms out on the sides in two large wings, causing the building to look like a large letter "H" with a nob at the top of the crossbar formed by the stack, which still has three sides to the weather. The Dartmouth College Library is the best example. In most libraries of this general type, the stack is designed to provide two tiers of shelving to each regular floor of the building and usually is about the same height as the whole building. In at least three libraries, however, this stack "tower" has really become a tower, rising to 19 tiers at the University of Rochester, 28 tiers at the University of Texas, and 16 tiers at Yale University. Another tower, probably higher than any of these and chosen frankly for architectural or memorial considerations, was until recently being planned by Ohio State University, but it is now understood that it is being modified. There is scarcely any room for doubt that the best opinion in the library world is unanimous in condemning the stack-tower as inefficient, inflexible, and uncongenial to modern library principles.

The third variant brings the stack farther into the interior of the building, retains reading rooms on the two sides and sometimes in front, and creates a building nearly or completely rectangular in shape. The library of the University of Virginia is so designed.

In all buildings of this general type, the stack is comparatively far removed from the reading areas. Most books needed by patrons of the library must be procured across the delivery desk. Even if the stack is thrown open to a large number of library users, the geographical distance between the books and the place the reader must work are formidable barriers to effective use of books. This is especially true of the buildings having tower-stacks. Alteration of the T-shaped and H-shaped building to bring books and readers into closer proximity is difficult and expensive and not apt to be especially satisfactory. The basic difficulty lies in the fact that areas built as stacks must

remain stacks and areas designed as reading rooms must remain reading rooms. Once erected, the building is fixed as originally designed, and changing demands for reading or storage space must go a-begging.

Placing the stack in the center of the building makes it possible to use the entire periphery of the building for reading and administrative purposes. Its compactness leads to economy in construction, for the shape of the building is usually rectangular. The Library of Congress Annex and the Nicholas Murray Butler Library at Columbia University are outstanding examples of this plan of construction.

Libraries with central core stacks are not necessarily easy to administer and are comparatively inflexible after construction is completed. Expansion of stack or reading areas is virtually impossible. Except for minor alterations, the arrangement of the building is frozen as it was originally planned. A central stack necessitates a corridor around the stack to provide necessary access to peripheral areas—a corridor which separates stack from reading areas. This corridor has been crossed in two places in the Columbia Library—in the case of the College Library and the Butler Library of Philosophy—at the expense of easy circulation between other parts of the building. Travel between reading rooms and departments on opposite sides of central stack buildings is apt to be long and circuitous. This difficulty has been somewhat mitigated in the Library of Congress Annex by providing a corridor through the stack between the east and west sides of the building.

Difficult circulation between reading and administrative areas in a central stack building may be solved by splitting the stack into four quarters, and moving the peripheral corridors to the center of the building. This has been accomplished effectively in the Los Angeles Public Library and somewhat less so in the Cleveland Public Library, with the advantage of having each reading room closely related to its own portion of the stack.

Books may be shelved in vertical adjacency to reading areas as well as in horizontal adjacency, so libraries have been designed with the stacks beneath the reading rooms. The most notable example is the Enoch Pratt Free Library in Baltimore,

where seven subject reading rooms, a reference reading room, and a popular library are located on the main floor. Each room has a substantial amount of shelving space within the room, and as much space on the two stack levels immediately underneath as it needs. Within the limits of those two levels of stacks, the arrangement is flexible, for the collection of each reading room may in general grow at its own pace, occupy what stack space it needs, and remain in close vertical proximity to its reading room. It is nevertheless true that individual units are not likely to grow at the same rate of speed and it is quite probable in such a compartmentalized library that some units may be greatly crowded in both reader and book space while others enjoy ample quarters. In short, this type of library, though it has flexibility within each unit, lacks fluidity in the whole. The new library at M.I.T. provides stacks below several separate reading rooms as at the Enoch Pratt Library, but avoids much of the foregoing criticism since these individual stacks are all part of a general basement stack and their boundaries may therefore be changed at will.

The exact opposite of the central core stack is found in the library having the reading room in the center of the building with the stack built around its periphery. The most interesting building of this type is the Brotherton Library of the University of Leeds, which has a large circular reading room 320 feet in diameter. Thirteen alcoves around the periphery of the room, with their galleries, provide shelving for 200,000 volumes, roughly divided by subject. The reader thus has immediate access to the library's major collections in all fields of knowledge, all located in the same room. Both stack and reading room are incapable of expansion, however, and access to the basement storage stack is difficult. A number of early American libraries were built on this general plan; examples include the old Columbia University Library, the Massachusetts Institute of Technology Library, the Union College Library, and the Chancellor Green Library at Princeton University. This type has generally been abandoned as unsuited to modern principles and uses. At the time these and other similar buildings were erected (from the mid-nineteenth until the early twentieth century), they were no doubt admirably suited to their pur-

pose as small college libraries. Their basic principle in planning was the concept of the wheel, with the spokes representing the various subdivisions of knowledge and the hub symbolizing the library and bibliographical machinery. Their basic fallacy was the assumption that the educational theories and practices they served would not change and that library principles would remain static. All have failed in the effort to meet the changes that have come to both education and librarianship.

Libraries have long provided some shelving in their reading rooms, usually around the sides of the room in wall cases. This practice is increasing considerably, particularly in buildings designed for the subject-division arrangement of reading rooms. Usually not all the books are so shelved, but the proportion is so large that the stack may be said to be within the reading room. Certainly storage functions and reading functions are housed in the same space. Thus the divisional reading rooms at the University of Colorado Library contain 75,000 books, those at Nebraska 50,000. Both libraries have conventional rear-of-building stacks for their less active collections. Indeed, this is the concept at M.I.T., where the reading rooms accommodate the largest part of the active material and the contiguous basement stack the less used portion of the same collection.

Two public libraries, those of Cleveland and Milwaukee, have managed to place all of their stacks within the subject-division reading rooms. In the Cleveland Public Library, built in the form of a hollow square, the stacks line the inner walls of the several subject reading rooms. In Milwaukee, stack installations vary in accordance with conditions in the different subject rooms. In neither case is expansion of stack possible without encroaching on reading space.

The major difficulty with most of the stack arrangements discussed above is their inflexibility. Once designed and constructed as stacks, stacks they must forever remain, so long as the building stands. Or, even if alterations are possible, they are so expensive or so difficult to achieve in a library which must continue to serve during alterations as to delay indefinitely their execution. The problem is not only one of the stacks becoming crowded and needing enlargement, but also one of changing ideas concerning the proper and most effective use of

books. The present tendency in many institutions of having students work with a much larger group of books than is possible in reserve-book rooms is frequently difficult to implement because of the wide separation of stacks from reading areas and the intrinsic character of both.

A solution lies in the erection of a library in which the building is the stack and the stack is the building and in which all possible space is free and easily adaptable to use as stack, reading, or administrative area. Divisional reading rooms, departmental libraries, and small reading cases can be dispersed throughout the stack floors, changed in size as desired, and surrounded with all relevant reading materials. This type of library is being planned or is already built at several institutions —the University of Iowa, Massachusetts Institute of Technology, Princeton University, the University of Georgia, etc.

Stack Construction. Until recently, most stacks built since 1900 have followed the multi-tier mode of construction first used for the extension of Gore Hall, the library of Harvard College, and perfected by Bernard R. Green for the stack in the Library of Congress. Stack tiers, normally 7′ 6″ high, are built one above the other as high as desired, and the whole structure is self-supporting and structurally independent of the remainder of the building. Such stacks represent the acme of efficiency in the shelf storing of books and have been used almost exclusively in the rear-of-building and center-of-building stack installations in American libraries for many years.

The major disadvantage of multi-tier stacks is the difficulty of shelving large numbers of books conveniently near their readers, and the impossibility of allowing large numbers of readers access to the stacks. For compact storage of books multi-tier stacks are satisfactory; for encouraging greater familiarity of readers with books, they are not. The frequency and multiplicity of supporting columns, together with the low ceiling height, make it difficult or impossible to convert stack space into reading or administrative space.

Because the multi-tier stack is designed to carry the full load of book storage, and because it is structurally independent of the remainder of the library building, it has usually been true

that reading and administrative space is not structurally strong enough to carry stacks and their heavy book loads. Library buildings with large reading rooms and multi-tier stacks are permanently committed to the arrangement determined by architect or librarian at the time the buildings were erected. Certain makeshifts are, of course, possible, but it is generally true that most library buildings of this type are not readily adaptable to changing ideas of book use and library administration.

Few contemporary librarians are willing to accept a building which imposes on the future the past or present pattern of book use and management. Almost every building now being planned seeks flexibility in some way. As a building concept flexibility is not new. Office and warehouse buildings have, for example, long been constructed so that interior space can be rearranged more or less at will. Such possibilities are implicit in almost any modern frame building and seem well adapted to the indubitable need of flexibility in libraries.

Flexibility may be obtained without much standardization. Where a building has any regularity of form, and when it is designed to carry essentially the same loads throughout, engineering considerations will result in some fairly specific column centering which will tend to be uniform. Such a centering may be and often is referred to as a module. This should not be confused with the modular concept of The Modular Service Association which is seeking to create dimensional standards for the building industry.

The librarian may wish to relate the column-centering module to the length or the spacing of stack furniture. The dimensions of the module at the State University of Iowa will be either 19½′ by 27′, or 22½′ square; the module at Princeton is 18′ by 25′.

There is no apparent reason why one of these modules should be better than another. The module can theoretically be of any size; and theoretically the greater the size, the greater the flexibility, since the area in which there will be no column will increase. However, as spans increase in length, floors necessarily increase in thickness and cost, and there are practical upper limits which most libraries cannot afford to exceed.

The mere provision of some standard column centering does not, of course, guarantee flexibility. At least one more consideration is necessary. Every avenue of vertical transportation, every elevator, every stair, every plumbing line places an immovable element in the building, or at any rate one which can be moved only at great cost. If such elements are spread through the building the floor layouts will be limited. Accordingly good modern practice seeks to concentrate these services in as few immovable core units as is consistent with the requirements of service and of law.

Up to this point there is general agreement as to how to achieve flexibility. It will be understood that to have flexibility every square foot of floor should be able to support books or people, and it should be possible to arrange in any area rooms to serve a variety of purposes. What is today a stack is to be changeable so that tomorrow in different form and arrangement it can be a seminar or a reading room.

Two general approaches have been followed. The simpler, possibly the more elegant and certainly the less thorough, is that in the original plans for the M.I.T. Library. Here the column centerings and the vertical service cores were the only fixed elements in plan. The floors were so spaced that between a structural floor and the ceiling above one might have either two tiers of stack, two levels of rooms approximately of stack height, or a room with a generous ceiling of close to 16 feet. Every square foot of the structural floors was designed to be able to carry a full book load so that the whole building could be stack if desired.

The other approach, characteristic of most of the Princeton plan, adopts a vertical module somewhat greater than the 7′ 6″ height of the standard free-standing stack (8′ 4″ for Princeton). If larger reading areas are required than seem desirable under the 8′ 4″ ceiling they have to be provided at the outset since the 12″ concrete floors can scarcely be removed.

M.I.T. then was to build a two-story loft at each structural floor level and thereby be enabled to build within this area, where desired, two levels of rooms (and, of course, to remove them when needed). Princeton provides more generously in the ceiling height of its smaller rooms but cannot so

readily change anything except the floor plan. M.I.T.'s proposed flexibility is therefore greater and more costly, since every room would have to have the higher ceiling once the lower ceiling is given up; the higher ceiling might in turn waste some cubage for many rooms of the service variety. The final M.I.T. plan was able to incorporate this idea only in some areas.

Interior Planning. Except for certain elements (elevators, main stair wells, toilets, and book conveyors), the location of which would be permanently fixed, a modular library about to be occupied consists, at each floor level, of a series of rows of columns, with no further interior subdivisions of any kind. All such subdivisions are created by means of equipment and furniture, not by means of bearing walls. Movable wall panels can be purchased and installed as part of the equipment, not as part of the structure, although obviously the structure must be planned in terms of dimensions that will permit their installation. Theoretically, at least, prefabricated wall panels should be cheaper than other forms of removable partitions.

Books are to be stored as in the traditional library, except that the shelving in the stack area (if there is to be one) is free-standing instead of multi-tier construction. If ceiling heights are established at 8′ 6″, the additional foot of space above the standard 7′ 6″ shelving height, less easily accessible to readers, can be used for shelving little-used books or can be left empty. The tremendous saving in cubage through the avoidance of high ceilings in the parts of the building devoted to human occupancy makes the wastage of space above the bookshelves a matter of lesser consequence, especially when the location of the stacks does not have to be confined to any specific part or parts of the building.

Wall partitions can be placed wherever desired within a module though the basic wall lines would be from column to column. The columns in the stacks may be made practically to disappear by making them parts of lines of bookshelving and wall partitions. Since a double-faced bookshelf is normally eighteen inches wide, eighteen-inch columns will merge nicely with lines of shelving. There need be few columns, or none, standing free in reading rooms, though this is dependent on the

size of the rooms. With a module 18′ x 25′ it is possible to create a reading room 25′ x 54′, or even longer, without having columns in the interior of the room.

Summary. Libraries which wish to store large collections of books as efficiently as possible have available to them the many variations of the multi-tier stack described herein. They may surround that stack partially or completely with as many floors of reading rooms as their present or future needs seem to indicate are necessary. Except for the rather limited collections which may be shelved within such reading rooms, access to the books in the stack may be provided across a loan desk to the majority of users and through the granting of special stack privileges to a minority. Buildings so designed will differ only superficially from those already in existence and in comparatively cumbersome use throughout the country. They will continue to cast book use in a large university library into the familiar mold of large numbers using few books in monumental reading rooms and barren reserved-book rooms—both of which smack of the high-school study hall. They will perpetuate the already obsolescing textbook or its related reserve-book method of teaching, for no other methods can be accommodated in a building so conceived and so designed.

Other libraries, interested in the eventual commingling of books and readers in a library designed for creative and intelligent work, will adopt some form of the modular construction idea. In this building they may segregate readers and books as in the more conventional building if such is the method of teaching and the mode of book use desired by the institution. But they may, as teaching methods change, as philosophies of book use move toward a recognition of the desirability of discriminating study of many books and of other library materials, form and mold the modular building to accommodate the new philosophy. This may be done all at once, if the change be sudden and revolutionary; or it may be done slowly as new educational ideas permeate slowly from one department to another.

CHAPTER V

AIR-CONDITIONING

It has long been recognized that there is a correlation between the life of books or manuscripts and the atmospheric conditions under which they are kept. The effects of humidity on various types of paper stock have been explored in a scientific way. To a lesser degree, depreciation due to the abrasion of dust and other air-borne agents has also been assessed. From the evidence existent, it is not possible to write a prescription for each manuscript and paper, but it is possible to describe *ranges* of temperature, humidity, and the like within which a book or manuscript will have the best chance of survival.

Even these ranges may be deceptive. Some papers, if they do not deteriorate too far, seem to achieve a certain stability with respect to their environment but are sensitive to changes. A manuscript which has survived for thousands of years in a sarcophagus may deteriorate rapidly when it is transferred. This does not mean that modern technology is at fault in its specifications. It simply means that some documents, like Everest climbers, require acclimatization, and if this is attempted too precipitately disaster may ensue.

Because equipment exists and can be installed for a price, it does not follow that the use of the equipment should immediately become part of a national standard. It is much too simple a statement, as well as an exaggeration, to aver that "no contemporary building will be anything but obsolete unless it is air-conditioned." It is unquestionably desirable for the modern library to be provided with air-conditioning equipment. But it is fallacious to assume that air-conditioning will be economic under any and all conditions. Air-conditioning will add substantially to the cost of any building constructed in the next few years. Every library builder should try to obtain air-conditioning for his building—of this there can be no doubt. But, on the other hand, it is a practical certainty that he will be faced with a building budget which is not limitless. When such a budget is stretched to its limit and still falls short of covering his building program, the air-conditioning cost will customarily

stand out as a large item, the elimination of which would permit a substantial cut in the budget without impairing the size of the building or the scope of the other facilities provided. At this point he will have to decide whether he would prefer to diminish his building or give up the air-conditioning. His decision may often, and properly, be to keep the air-conditioning at the expense of some desired spaces. But all too frequently he will find that he still has not cut his budget far enough. Then the question becomes more difficult: shall he refuse to have a new library building at all unless it can be air-conditioned? There are relatively few situations in which the answer to so hard a question would properly be "yes."

Thus, each situation becomes a particular and local one. If the librarian is the custodian of a substantial quantity of irreplaceable treasures the monetary value of which is not easily assessed but the importance of which to society is unquestioned, proper air-conditioning for the protection of these treasures should be insisted upon. If the quantity is smaller, a more modest air-conditioning installation for a room or two should be contemplated, even though this imposes some limitations on the systematic arrangement of all the library's holdings. If the quantity is still smaller, or if even a small installation cannot be afforded, then the librarian might properly consider placing the precious material elsewhere, where it can be protected. The responsibility of a librarian to society with respect to such material is greater than his responsibility to the pride of a single institution.

At the next lower level of urgency can be placed the substantial amounts of material which are not irreplaceable but which will be hard to replace, and costly to replace as well. Here the problem becomes more sharply one of economics. If it were possible to estimate the value of the holdings in this category (on a replacement basis) and the probability of deterioration, it should be possible in a general way to set up a comparison of the annual losses to be expected if air-conditioning is not provided against the annual cost of air-conditioning if provided, including of course in the latter the usual charges for amortization, maintenance, and depreciation of the original capital

investment in air-conditioning equipment.[1] It is safe to say that for most significant collections this calculation will turn out in favor of installing the equipment.

At the bottom of the scale lie the large numbers of books and other library materials which are neither hard nor costly to replace. If these are to circulate outside the building the problem becomes increasingly complicated, for it will be realized that while they are *out* of the building they will normally not be in an air-conditioned environment. This passage of materials to and from the air-conditioned environment surely reduces the marginal value of air-conditioned storage. Here air-conditioning will usually become desirable rather than essential; it will be difficult to establish an economic case for its installation.

Of course local climatic conditions are an important factor when books in the latter category are under consideration. There are climates which are simply too wet or too dry to justify considering a building without air controls; there are atmospheres which are so dirty or so polluted with the destructive gases of industry as to make the air-conditioning essential.

This is perhaps the place to sound a warning to the librarian who is in a quandary. There is no magic in an air-conditioning equipment. As in most well-developed mechanical arts, one is not likely to find bargains, likely to get only what one pays for. The librarian who is taken in by startling claims is simply indulging in wishful thinking. It is always possible that new inventions may alter the economics of air-conditioning, as indeed more widespread use might. The librarian, however, is not in a position to assess the new developments and should not pursue them as will-o'-the-wisps. Rather he should employ engineers whom he believes to be progressive and obtain a thorough assessment of any new proposals before he adopts them on the promise that they will be cheaper than the ones with which he is familiar.[2]

Another decision which is likely to prove fallacious should

[1] A case study of this sort in one of our library schools might make a valuable contribution.

[2] A reference should perhaps be made at this point to "Modern Air Treatment," by R. H. Gates, in H. H. Fussler, ed., *Library Buildings for Library Service*, Chicago: American Library Association, 1947, pp. 114-40, which is cited in our Bibliographical Essay, below, p. 185.

also be discussed. This decision has often been reached as a matter of expediency. It postpones the installation of air-conditioning equipment until more money is available. The fallacy is likely to be twofold. In the first place, it is not consistent with the mores of educational institutions that a more or less completed building will later be given substantial funds to finish it according to plans. The pressure of other unbuilt and needed structures is usually too great—and the glamor of the new one exceeds the glamor of installing air-conditioning in an old one, whether the matter is viewed by a donor or by an administrator.

In the second place, it is not easy to design a building this way. Air-conditioning ducts, for example, will consistently be smaller than those required for full ventilation without air-conditioning. Thus the librarian who decides to postpone the installation of the equipment will find either that he has to install oversize ducts at a cost not much less than that of the air-conditioning or if he installs ducts of the finally appropriate size he will have to supplement his ventilation by the use of open windows.[3] The latter at once introduce dirt which is entirely undesirable.

Hence, although the postponement may possibly work out favorably, the cards are stacked against it and any such proposal should be approached with a healthy skepticism.

Air-conditioning also has an effect upon the occupants of a building, both the transient and the permanent. In some climates of the United States, particularly those of the South, it is likely that air-conditioning for comfort is essential to efficient

[3] Nevertheless, says the architect R. B. O'Connor, "This is just what we did at Princeton and I believe wisely. In our case the ducts *were* sized for air-conditioning though this meant more original cost than ordinary ventilation, and the fan-rooms are designed for the installation of refrigerating apparatus which is not yet put in except for the Special Collections areas. Our argument—and I believe it has validity—is that the *maintenance* of full air-conditioning is so out of balance with other buildings on the average campus that it will not be continued after the first year or two (*vide* Butler Library at Columbia) until the whole advance of popular thinking has come to include this among its accepted standards. To date this is hardly the case. But we want to have temperature and humidity control throughout the Princeton Library as soon as it is economically and psychologically possible—and then it would be at a staggering installation cost if we hadn't anticipated it."

work. But this applies to all buildings on the campus and not to the library only. If air-conditioning for comfort has become a part of university policy with respect at least to all new buildings, the library should certainly not lag behind. But if, as in the North, this is not an essential element of general policy, the librarian stands on weak ground when he seeks air-conditioning for this purpose. It is probably true that an air-conditioned library on a non-air-conditioned campus will draw students to the library, and this is surely desirable. But, on the other hand, university administrators may justifiably view with suspicion a differential treatment amongst the university family, and this attitude should be respected by the librarian.

In general it can be said that the marginal cost of air-conditioning an entire stack will not be in proportion to the cost of air-conditioning a part of the stack. On the other hand, it would be practically possible to air-condition the whole of a unitary area for the storage of library materials without air-conditioning the rest of the building, and thus save a substantial sum. The decision as to whether or not air-conditioning can be afforded should therefore be made early. It would be very hard, for example, to work out air-conditioning for part of a building which is intended to be fully flexible as to later space-use or for part of one in which the stacks are widely separated as in some divisional schemes. The basic program for the building plan must therefore rest in part upon the question of air-conditioning. Other factors, such as the need for a divisional library, may predominate, but all the factors should be taken into consideration in writing the program.

It will be apparent from the foregoing that the decision whether or not to air-condition is at the present writing a very difficult one to make save in the most clean-cut situations (as for example the Houghton Library at Harvard). It is very much a local decision. In these circumstances the Committee is quite unable to make sweeping generalizations. The best it can do is to present the facts concerning the various elements and processes of air-conditioning. This will be done in the following paragraphs.[4] The presentation is deliberately a primer one, on

[4] The Committee is indebted to W. Ward Powell, Jr., for most of the technical matter which follows. For essential bibliography see below, pp. 185-186, notes 41-48.

the ground that it will hurt the partially informed reader less to examine the obvious than it will hurt the uninformed to overlook it.

WHAT IS AIR-CONDITIONING?

Air-conditioning in the strict sense means the simultaneous control of eight factors, viz., temperature, humidity, air motion, air distribution, dust, bacteria, odors, and toxic gases. Examination of each of these with an eye to the specific problems of libraries and archives will determine which can be discarded or placed in a subordinate position, when finances dictate, and which *must* be controlled regardless of cost.

Temperature. The effects of temperature on books and manuscripts have been inadequately studied and are not well known. It has been maintained that the only known effects are charring or discoloration of papers at higher temperatures and deterioration of glues below freezing. However, at least under certain climatic conditions, there is a relationship between temperature and humidity. Experienced librarians know that when a library is overheated over long periods in winter, paper and bindings tend to dry out and become brittle, and many will share the view that most of the deteriorating influences which act on paper are accelerated at higher temperatures. In general it may be said that a temperature of 65°F. to 70°, or even 75°, will be found satisfactory for books, though a considerably wider range may be tolerated, provided humidity is properly controlled.[5]

From the standpoint of human comfort, the requirements are more exacting. It has been found that in the winter a majority of people are comfortable at temperatures from 67° to 77°, with a maximum number comfortable at about 70°. In summer, the range is from 72° to 82°, with a maximum number comfortable at about 77°. This difference between seasons can be explained by two factors: first, that people in winter are accustomed to and expect lower body surface temperatures

[5] H. M. Lydenberg and J. Archer, *The Care and Repair of Books*, New York, 1945, p. 5; J. Grant, *Books and Documents*, London, 1937, pp. 143-44, 146.

and, second, that people wear more and heavier clothing in winter.

The body is so constructed that the sweat glands are able to maintain tolerable control within the ranges stated above. This means that in normal, healthy persons the glands will operate to satisfy the requirements of a particular individual when subjected to temperatures within these limited ranges. Therefore, this range is the most healthful for normal persons.

A word of caution is necessary about summer cooling. The possibility of "shock" (due to the effect of abrupt changes of temperatures on the body) is great and must be guarded against. It is evidenced by dizziness, fainting, and/or cold sweat. Shock may be experienced either on entrance to or exit from buildings in the summer when the room temperature is maintained too low relative to that outside. A small drop in temperature as one enters an air-conditioned space is refreshing (and incidentally less costly to produce), whereas a large drop is quite uncomfortable.

Another physiological principle concerns the duration of exposure to a cooled installation in warm weather. Transients will be satisfied with higher summer room temperatures because they do not have time to become fully acclimated. On the other hand, librarians and students remaining in the cooled space for long periods of time will prefer lower temperatures. An investigation of the students' habits will aid in determining a satisfactory temperature for summer work. Possibly several trials at different temperatures will be desirable.

Operating costs for either winter or summer conditions are, of course, lower when little change from outside temperature is required.

To summarize, though the deleterious effects of extreme temperatures on library materials are obvious and though even moderately high temperatures in winter may be very damaging, our knowledge of this subject lacks exactitude. The effect of temperature on human comfort is so clear as to require little discussion. The criterion for a satisfactory room temperature is to maintain approximately 70° in winter and 77° in summer, with allowable deviations. Caution is to be exercised with re-

spect to lower summertime temperatures because of the possibility of shock.

Humidity. The effects of humidity on library materials are best illustrated by extreme conditions. A very low relative humidity will cause the paper to become brittle so that it will easily become damaged even under reasonable handling. The glues, too, will lose much of their flexibility. In addition, a very dry substance acts somewhat like a blotter and will pick up moisture and oil stains from fingerprints quite readily. Conversely, if the air is too moist, it reduces the tensile strength of glues; it also opens the way for damaging chemical action. Not only are chlorides converted into hydrochloric acid in the presence of water, but paper which is moist appears also more readily to absorb other impurities from the air. Moreover, a damp condition is ideal for bacterial growth (provided other conditions of growth are satisfied). It is generally held that relative humidity for library materials should be about 50 per cent.

Human beings can be fairly comfortable through a wide range of relative humidity. Yet here again extremes are undesirable—air which is too dry affects the throat and nasal passages, and air which is too moist affects the normal operation of the sweat glands. Human comfort is experienced in a relative humidity of about 30 per cent to 70 per cent, with a maximum number of persons experiencing it at about 50 per cent.

A recommended range of relative humidity for libraries would be approximately 40 per cent to 50 per cent for winter and summer. An exception must be made for severely cold weather where a building has one or more walls exposed to outside conditions: in such a case condensation may take place, especially if single-glazed windows are present. Because the effect of condensation on the building itself is harmful it becomes necessary to minimize such a possibility. This can be done by lowering the relative humidity when necessary to something less than 40 per cent. Short exposures of library materials to this lower level of humidity will not be serious. However, as soon as weather conditions permit, the humidity should be raised again to the normal range of 40 per cent to 50 per cent.

Air Motion. The motion of the air around any particular point will be discussed here: the distribution of supply air to all points in a room will be taken up below under *air distribution.* It has been found experimentally that air motion is of extreme importance to human comfort. The two important desiderata are elimination of stagnation zones at zero velocity and elimination of high-velocity gales. When the velocity is low, the air surrounding human beings becomes saturated with evaporated perspiration, becomes increasingly warm, and carries a characteristic odor. Aside from the obvious undesirability of the first two of these conditions, the physiological undesirability of the third can be seen by investigating the action of the pores of the skin. The pores give off moisture at a given rate to maintain human comfort. But when the moisture is evaporated into stagnant air zones, the pores must open further to allow proper balance because of increased humidity in the immediate region. Any movement by the person or by the other nearby persons will cause new air to replace the stagnant air, thus creating in effect a mild form of shock. Therefore, it becomes necessary to avoid this region of stagnation or zero velocity.

The effect of high velocities is to increase the rate of evaporation of perspiration, thus tending to make a person feel cool or cold in an otherwise quite comfortable room. Although this is objectionable, it is not very serious unless the velocities are extremely high. People are then subjected to drafts which assist in "catching cold." The blowing of papers by high velocities is also objectionable. Therefore, a normal velocity range for air motion should lie between 15 and 50 feet per minute. Differences of opinion will produce quite heated arguments as to an exact figure for the "best" air motion. However, the present writer is of the opinion that lower velocities, of say 15 to 25 feet per minute, are more suitable than higher ones for the type of installation that is under consideration.

Little appears to be known about the effect of air motion on books, but it is confidently believed that mildew growths are more prevalent in stagnant air. Therefore, if is important to avoid stagnation in a storage area, and an air motion of 15 to 25 ft./min., which is suitable for human beings, would seem

also to be satisfactory in the interest of preventing mildew formation.

Air Distribution. Since proper air motion is extremely important both for book storage and for personnel, it is evident that the system of distribution must be such that there will be adequate circulation at all times in all parts of the building. Therefore, the mechanics of distributing the air must be considered thoroughly.

There are three common types of outlets in a room which may be used to distribute the air properly. These are classed as jets, diffusers, and grilles or registers. The jet method of distribution utilizes narrow openings—either small circles or long narrow slots. This type of installation is characterized by an extremely high outlet velocity which is slowed down to a reasonable value (15 to 50 ft./min.) within the occupied zone or section. Such extremely high velocity is usually accompanied by a high pitched noise which is difficult to overcome in situations where extreme quiet is necessary (as contrasted with an office filled with typewriters or billing machines where the noise would not be objectionable). Jets are usually placed at high points in the room, far above the heads of the occupants, and so directed that air is forced into all portions of the room. Such an installation in a room is good in the sense that the outlets are small and unnoticeable. However, the noise factor must be taken into consideration.

Another type of distribution device is the diffuser. Two different types exist in common practice. One uses a ceiling which is completely pierced with very small holes through which the air may flow. This type of diffuser is useful in a low-ceilinged room where the space above the heads of the occupants is relatively small. In such a situation it is difficult to inject a high velocity stream of air without hitting the occupants; but the perforated ceiling allows a large net opening through which the air may pass at a comparatively low velocity.

The perforated ceiling is used most commonly in buses, airplanes, and broadcasting studios. The reason for this application in the first two is obvious. The noise factor accounts for its use in the last. Since the net opening over the entire ceiling is quite large, the outlet air velocity is small and thus quiet.

The second type of diffuser in common use is the rosette or circular ceiling diffuser. The action here is one of moderately high speed directed to all parts of a circle above the heads of the occupants. The supply air moving in this pattern introduces tremendous quantities of "secondary air." Secondary air is the normal room air that has been brought into motion by the movement of the supply air. This reduces the high velocity of the supply air and increases the velocity of the normal room air. This rosette type of installation is often used in offices, theatres, and other similar buildings. Here again manufacturers' catalogues should be consulted for the particular noise level of a given model or unit.

Grilles or registers make up the third class of distribution devices. These are the openings which are used most frequently. They come equipped with blades which can be directed at will, thus making them suitable for use in odd-shaped rooms. The outlet velocity can be maintained at a low value merely by increasing the overall size of the outlet. However, grilles become unsightly when extremely large. This objection can be overcome to some degree by splitting the supply air into two or more streams and using separate outlets for each. Again care must be taken not to place too many outlet units in a given area, which will also be unsightly.

The mechanics of moving the air from a heating or cooling device through the walls and ceilings should also be mentioned. Ducts specifically designed to handle a given number of outlets—either jets, diffusers, or registers—are usually constructed and placed in the walls and ceilings during the erection of the building. Thereafter, this duct work will be very difficult to change and a certain degree of flexibility is lost. However, this is not too serious, because the requirements of air for a building are not likely to change, although the space may be utilized for a different purpose. What appears to be a decrease in flexibility in reality takes on minor proportions.

If full partitions are to be erected from time to time in a flexible building, care must be taken to provide adequate air distribution under the new conditions. It must be remembered that each outlet is designed to accommodate a given section of the building and that if the building is reapportioned it is nec-

essary to insure that each new section shall have adequate air supply and exhaust. This is most true where partitions extend from floor to ceiling.

Another method of bringing the air from a conditioning unit to the occupied space is by the use of a specific example of modular construction proposed by Angus S. Macdonald in which hollow prefabricated columns are used to carry the air as in regular duct work.[6] From the architect's viewpoint this may be quite satisfactory since it eliminates some of the cost of duct work. However, many engineers have expressed the view that it involves a fire hazard, and since all of the columns would be of substantially the same size, in order to supply a large volume of air through some of them it would be necessary to use an extremely high velocity. This is objectionable technically for two reasons: first, the probability of the generation of noise within the column which is easily carried into the occupied zone; second, the fact that as velocities are increased the necessary power consumed to supply these higher velocities varies not directly but as an exponential power of the velocity. This simply means that operation costs will be increased for as long a period as the building is in operation. The librarian should be thoroughly satisfied that these objections are not valid for his building before he seriously considers modular air-conditioning.[7]

To summarize, proper air distribution is accomplished by the proper selection of outlets. What class of outlet—jets, diffusers, registers—should be used will depend upon the desired result within the conditioned space. Again it should be stressed that each application has its own specific characteristics and must be dealt with accordingly.

Dust. Dust control in a library is imperative because of the abrasive action of dust or fine particles of dirt upon books and

[6] A. S. Macdonald, "New Possibilities in Library Planning," *Library Journal*, LXX (1945), 1169-74.

[7] Modular ventilation is being used at Princeton without the high velocities criticized, "because the building is divided into zones vertically and the large quantities of air required for large areas are handled by big horizontal ducts. The smaller vertical ducts only handle the air from one 18′ x 25′ bay on each of three floors." R. B. O'Connor in private correspondence.

other library material. Dust is removed from the supply air going into a conditioned space by three common methods: washers, filters, and precipitators. A water air washer consists of a series of nozzles which spray water into the stream of supply air. This water removes any dust or dirt particles with which it comes in contact. As would be expected, the number of dirt particles which are removed from the air stream is a function of probability. Therefore, the more nozzles in series used, the more dirt will be removed. It should be pointed out that the use of this air washer will increase the relative humidity of the supply air to a point close to 100 per cent. Because of this fact water washers may be used to accomplish a dual function, viz., humidification and cleaning.

Air washers may use any of several different fluids. Water is the most common one and it humidifies the air when used. The other class of fluids used in washers are moisture absorbents such as triethylene glycol, lithium chloride, etc. Since the air washer can be used for two purposes, i.e., dust removal and humidification or dehumidification, any application of an air washer to remove dust and dirt particles must be designed so that the proper humidification will result. Although there have been fantastic claims made for special fluids, these claims must be viewed with an eye toward the source. It is easy to be misled by the assurance with which they are put forward. It is necessary to be on guard against claims which as yet are not well established.

In addition to the washer class of dirt removers, there is a common class of inexpensive filters. These consist of a framework on which is suspended spun glass, fiber, wire mesh, or any other matlike material. Spun-glass filters, because of their low cost, can be discarded when they are filled with dust. Metal mesh filters can be washed and reinstalled. As would be expected, the metal mesh filters are initially more expensive, but their replacement costs are small.

These mesh, or mat type, dirt removers are often impregnated with oil which has a high surface tension. This means that any dirt particles which are trapped in the filters cannot be easily dislodged. One example of the use of an oil filter is that of a continuously moving endless belt composed of mesh-

like material. This endless belt dips into an oil bath, then rotates through the air stream, and returns again to the oil bath. In the oil bath dirt particles collected in the mesh are deposited in the oil supply, and the mesh is thus cleaned for a new passage through the air stream. This, then, is a continuous, self-cleaning device which is expensive initially but the maintenance costs of which are negligible.

The third class of dust eliminators includes the precipitron or electro-static dust precipitator. In this device dust particles are electrically charged and passed between two large plates which are charged, one positively and the other negatively. As the dust particle passes between these plates it is repelled by the plate with a like electro-static charge and is attracted to the other plate where it remains until removed. Precipitrons not only offer a small or negligible resistance to the flow of air (consume a small amount of power to overcome resistance of air flow) but, in addition, remove a very large amount of dirt. To date, this device removes more dirt from a given specimen than any other known device. Therefore, the precipitron should be recommended where absolute dust control is essential. Because of its necessarily high initial cost it can be afforded only where it is necessary to remove a maximum amount of dust or dirt.

One disadvantage of the electro-static precipitron is that it requires high voltages (in the neighborhood of 14,000 to 20,000 volts) and that great caution is necessary to prevent intimate contact with such a unit. This disadvantage is overcome to a limited degree by the underwriter's code controlling the specifications of the manufacturer. Another cited disadvantage which is not very convincing is that it must be cleaned periodically, as is the case with most other devices.

It should be pointed out that smoke comes under the classification of dust or dirt. Therefore, when smoking is permitted in a library, an air-cleaning device should be selected which will remove tobacco smoke from the air.

To summarize, air washers can be used to clean and either to humidify or dehumidify the air. Filters are relatively inexpensive but do not remove a maximum amount of dirt. Electrostatic precipitrons remove a maximum amount of dirt but are

quite expensive. For proper housekeeping in a library, frequent vacuum cleaning is necessary to remove dust and dirt that do not get into the normal air cleaner on the supply air circuit. It must be performed despite the fact that an adequate dirt remover is installed in the conditioning device.

Bacteria. Far less is known about the effects of bacterial action on books and manuscripts than upon persons. About all that can be said is that it is desirable to minimize favorable conditions for bacterial growth wherever possible, or to introduce unfavorable conditions which will inhibit growth. There are on the market at the present time several types of sterilization lamps which can be installed in rooms or air ducts to kill bacteria by radiation. These are worthy of consideration in the interest of human health, though it is improbable that they have ever been thought necessary for the preservation of library materials.[8] Whether they should or should not be included in an air-conditioning system would depend more upon the general policies of university executives than upon library administration.

Odors. Odors have been neglected in most studies of air-conditioning. Just what an odor is or what effect it has is still a matter of conjecture. However, one theory contends that odors are vapors of substances which are soluble in water, differing materially from a neutral solution (neither acidic nor basic). The more objectionable or pungent odors give solutions which depart more from the neutral than those of pleasant or faint odors. If this be true, then odors could be important symptoms of a condition which could cause the deterioration of records, or any other substances which contain water, just as gases may. However, this field has as yet been inadequately explored and future developments will have to be followed for a more adequate treatment.

Gases. Certain chemicals, notably sulphur dioxide (SO_2) which is a waste product not only of certain industries but of

[8] Reference may now be made to a report of the Committee on Air Sterilization and Air Conditioning of the American Hospital Association entitled "The Disinfection of Air," Bulletin No. 229 (1947) of the American Hospital Association, 18 E. Division Street, Chicago.

the combustion of fuels containing sulphur, are known to have very detrimental effects upon all types of paper and bindings. The difficulty arises from acidity. Sulphur dioxide tends to combine with the moisture in papers and bindings to form sulphuric acid, which causes discoloration and in time disintegration. Therefore, if a library is contemplated in a region where harmful chemicals are found in the atmosphere, it becomes imperative to remove these chemicals before introducing the air to the conditioned space. This removal is usually accomplished by an air washer which contains the necessary counteracting chemicals.

Toxic gases such as carbon monoxide (CO) must of course be removed. This may also be done by processing in an air washer or by absorption in a suitable substance.

Legal Factors. Legal restrictions may have a bearing on air-conditioning. Some communities have ordinances governing the amounts of fresh air to be introduced into a building of public use. Prescribed amounts are usually expressed in terms of cubic feet per person per minute and vary with the type of room and its use. Local ordinances must be consulted for any such restrictions.

Smoking. Smoking, previously mentioned under dusts and elsewhere in this monograph, requires additional consideration. A larger quantity of circulated air is necessary in order to insure that the density of smoke is held to a practical minimum. Frequently a space will have a normally sufficient air supply to accomplish proper air motion, but when smoking is permitted this supply becomes insufficient to carry away the smoke. Therefore, general policy with regard to smoking should be determined early, in the design stage, so that ample duct sizes can be provided. Often it is possible to set aside certain rooms or areas for smoking, but under no circumstances should it be permitted in the vaults.

Where smoking is permitted it should be noted that the perforated ceiling type diffuser is not very satisfactory as a supply outlet. Normally smoke tends to rise and it should be removed as promptly as possible. If it meets an incoming supply of air from the entire ceiling area, the two streams mix together and

a contaminated air results. For best results it is necessary to provide an exhaust outlet in or near the ceiling and as close to the smoking zone as possible.

Controls and Equipment. A way of controlling temperature and humidity in large buildings, or buildings divided into utility zones, is zone control. Thermostats and other controllers are placed within each zone and operate equipment which affects only the area in which the controls are placed. For example, a large library is exposed to a prevalent north winter wind and on a given floor the entire area is open. In this case the north side of this floor will require more heat than the other parts of the building. Despite the large common area, by using zone control more heat can be directed to the northern portion of the building, thus equalizing the temperature within the area. However, such refinement is necessary only when there are large rooms with unequal loads, or when there are many small sections with different loads which vary independently.

Humidity can be raised by passing air through an air washer which circulates water above the dew point of the air entering the washer. The usual practice for humidifying heated air is to evaporate moisture from a pan within the heating unit. To lower humidity, spray water is used which is lower in temperature than the dew point of the air, or the moisture is frozen or condensed on the surface of refrigerated coils or else absorbents are used.

The usual equipment for all-year air-conditioning consists of heating and cooling coils placed before and after an air washer, which are individually controlled by thermostats and humidostats. Heat exchangers are also used on the spray water. Thus by the proper combination of coils in conjunction with the washer, any desired condition of temperature and humidity can be reached. Frequently in summer it may be necessary to cool the air to remove excessive moisture and then reheat it somewhat before introducing it to the conditioned space. This point is usually difficult to explain convincingly to persons unfamiliar with conditioning technique because it appears a gross waste of money to refrigerate air and then reheat it.

However, when resulting changes of humidity are considered the expense of reheating is justified.

Refrigeration equipment is necessary for a summer cooling installation, not only to cool the air but also to control the humidity. Briefly, this equipment falls into two classes—compression and absorption. Various refrigerants are used in compression machines, the most common being ammonia, freon, sulphur dioxide, methyl chloride, carbon dioxide, and water. Each refrigerant has its advantages and disadvantages. The most glaring disadvantage of ammonia or sulphur dioxide is the toxic effect when leaks occur. Carbon dioxide requires very high working pressures, and water requires high vacuums or very low absolute pressures. Consultation with engineers will determine a suitable refrigerant for use in libraries. The absorption system uses a gas flame as the power source and can perhaps be used economically in a locality where gas rates are very low.

It must be remembered that the most economical air-conditioning operation occurs when there is little change in temperature from an available heat reservoir, or source. Therefore, it follows that if any low-temperature source is available in summer it should be used. For example, if an artesian well is present it should be considered for summer cooling work; and likewise available hot springs in winter. Much information has been published concerning the heat pump, or reverse cycle refrigeration, as a device for all-year conditioning. This makes use of the approximately 70° earth as a source of heat in winter and a sink, or heat receiver, in summer. Wherever possible (i.e., when there are low power rates and a convenient source and sink) the reverse cycle system should be given due consideration.

Conclusion. The Committee finds itself unable to make categorical recommendations for the air-conditioning of all future libraries. It can categorically state that the original thinking about a new library should not exclude air-conditioning, because it is so important a component of a truly modern building; it can urge that the decision as to how much air-conditioning can be afforded should be taken early in the writing of the program and with specific rather than general advice from

experts; it can honestly suggest that some other elements of a library can appropriately be sacrificed to air-conditioning if the budget requires. But exactly how much can be sacrificed and at exactly what point it will be justifiable to give up the idea of air-conditioning in favor of realizing the library at all, will rest on very concrete local considerations. It is possible to assert that for most conditions and for most collections it would be ridiculous to sacrifice the building simply because this modern but unattainable technique is clearly desirable in every modern library. There are very few collections, on the whole, for which it can be demonstrated to be indispensable.

CHAPTER VI

MODERN ILLUMINATION[1]

THE provision of proper lighting in the planning of a library building has always been of major concern to librarians and architects. And, paradoxically, proper and satisfactory lighting has been achieved less frequently than almost any other feature of the library buildings erected during the twentieth century. We do not need to seek far for the reasons, for only recently has research on the problems of vision and the nature of light brought forth definitive answers to the question: "What is good lighting?" There have been, however, other reasons for the poorly designed lighting systems in library buildings. Unawareness of existing knowledge, unwillingness to retain expert lighting consultants, and compromises with cost have also contributed their share to the prevalence of bad lighting in libraries.

Even though much progress has now been made in the theory and practice of good lighting, much still remains to be done. Differences of opinion, even controversies, still exist. Certain principles, however, are becoming clear and may be used with confidence in the planning of a library lighting system. Continued research in the field may be expected to contribute new adaptations and new applications, particularly in the construction of fixtures designed to meet special and individual conditions. Most of the principles may now be almost categorically stated for the guidance of architect and librarian. Their application in the design of a large library system should, however, be entrusted to a lighting engineer who may be expected to show how his application expresses the principles, or

[1] Material for this chapter is in large part drawn from the Thursday afternoon session on "Lighting" of the Second Princeton Conference of the Cooperative Committee, held in June, 1946. Principal authorities present were Dr. Gertrude Rand, Institute of Ophthalmology of the College of Physicians and Surgeons at Columbia University; Mr. Ward Harrison, General Electric Company, Nela Park, Cleveland, Ohio, and Mr. Bassett Jones, Electrical Engineer.

why a different principle and application are preferable in a particular situation.

Brightness Contrasts. Basic to all considerations of good lighting are the principles related to the comfort and efficiency of the eye. First of these is the fact that high brightness contrasts and high brilliancies in the field of view fatigue the eye. The art of good lighting is the art of proper distribution of brightness. A person who goes into a dark room and lights a match is blinded and sees nothing in the room. It is necessary to shield the eye from even that little flame. Gradually the eye adapts itself to the light, and it is possible to see a few things, provided the eye is shielded from the direct light of the flame.

Conversely, if the walls, floor, and ceiling of a considerable room should be painted white and a bare 1,000-watt incandescent bulb be hung in it, it would be possible to be reasonably comfortable in that room, provided the lamp were not looked at directly, because the contrast between the light source and the room would be low. In the dark room lighted by a match, the contrasts are so high that the eye can hardly function. The darker the finish of a room, the less light you can properly have in it. The selection of interior finish may well be more important than the selection of one type of lighting fixture or another.

Good lighting should allow the reader to have a uniformly illuminated field of view. Brightness should shade off, if at all, very gradually in all directions. The periphery of the eye is more sensitive to brightness than the center, and must not be exposed to high brilliancies. The pupil of the eye contracts sharply to high brilliancies at the edges of the field of view instead of assuming the size proper to the level of illumination on the matter being read. The work being done should be the brightest thing in the field of view. Only then will the eye be adapted to the work, and not to higher brightnesses in the field.

It is not always recognized that there are many pain nerves in the iris and that a very strongly contracted pupil is definitely painful. This is the cause of the sensation of discomfort experienced when going suddenly from a low illumination into a high

one, and also of the discomfort experienced by many people when they remain for a long time in a high illumination, such as bright daylight.

How Much Light? The reader of a book needs a sufficient amount of light to see easily and quickly the work he is doing. For reading ordinary type on good paper, most young eyes do not need more than 12 to 15 foot-candles if the light is well diffused and there are no high brightness contrasts in the field. However, the rule cannot be followed too rigidly. Some individuals need more light and some less. The Committee is not convinced that it is necessary to accept proposals which have been made to provide as much as 40 to 50 foot-candles for ordinary classroom or library reading.[2] It is supported in this view by a recent study of readers' preferences that was made in preparation for the relighting of the Harvard Business School.[3] Nevertheless, in view of the sharp differences of opinion which are to be met with on this subject, we are reluctant to accept any fixed number of foot-candles as a general norm for library lighting and urge that each problem be given individual study.[4]

In planning his lighting, the librarian should also remember that a considerably higher level of illumination needs to be

[2] See, for example, James M. Ketch, "Library Lighting," in *Bulletin of the American Institute of Architects*, 1 (Sept., 1947), 86, who adopts the "recommended standard practice" of the Illuminating Engineering Society.

[3] Alfred H. Holway and Dorothea Jameson, *Good Lighting for People at Work in Reading Rooms and Offices*, Boston: Harvard University, Graduate School of Business Administration Division of Research, 1947.

[4] A closer, though technical, statement has been made by H. L. Logan, manager of the Department of Applied Research, Holophane Co., Inc., who reviewed this chapter for the Committee in manuscript: "40 foot-candles in service simply means that a detail as small as 3 minutes of arc, with 5% contrast with its background, can be seen at 90% of the maximum possible rate; that the same detail with a 10% contrast can be seen at 95% of its maximum possible rate; or that the same detail with 40% contrast can be seen at 98% of the possible maximum rate, or that the same detail with 80% contrast can be seen at the 100% visual rate. If the grade of difficulty of task indicated by size of detail and contrasts mentioned above is characteristic of library work, then 40 foot-candles is necessary. If not, a determination of typical contrast and detail size will automatically determine the minimum level of illumination at which the work can be done for whatever visual rate is considered desirable."

provided initially in order that the "in-service" level shall be as specified. People tend to delude themselves as to the practical facts of maintenance. Deterioration will be from 25 to 50 per cent. This means, for example, that an initial installation to provide 40 foot-candles will probably after a few months yield no more than 20 to 30 foot-candles.

Because of its great range of adaptability, the eye "can function efficiently probably over a range of 10,000:1,"[5] although continuous work should not be done at the lowest or the highest end of this range. It takes about twenty minutes to adapt the eye completely from a high illumination to a low one. It takes only about five minutes to adapt from a low illumination to a high one. This is reflected in everyone's experience. When coming indoors at night, rooms at first seem brilliantly illuminated, but it takes only a short time to become used to them. But when coming indoors from bright daylight, rooms seem very poorly illuminated, and it takes longer for the eye to make the necessary adjustment. This is a reason for providing a fairly high interior illumination for daytime use.

Though the level of illumination is important, it is less important than the brightness distribution in the room and the diffusion of the light. Eyes are better off reading with less light, if high brightness ratios cannot otherwise be avoided. This is true of normal eyes and for normal work. Defective eyes, or difficult work, such as the reading of very fine type with poor contrast of type with paper, will require a higher level of illumination. Thus, for normal vision, the amount of light required depends on the size of detail to be discriminated and the contrast between the work and the immediately surrounding area.

✓ Good lighting is dependent upon many other factors besides the light source and the level of illumination. Tables, desks, ceilings, and walls should in general be lighter than is common in present practice. The ideal reading surface would include print on paper in as great a contrast as possible, black on white, and a surface surrounding the page of nearly the same bright-

[5] LeGrand H. Hardy and Gertrude Rand, "Elementary Illumination for the Ophthalmologist," *Archives of Ophthalmology*, XXXIII (Jan., 1945), 1-8.

ness as the page itself. Since in reading we are, as a rule, dealing with a page of print, this brightness is substantially lower than would be that of a sheet of white blank paper. Thus the table top should not be white, though it could well be much lighter than library table tops have traditionally been. If error is to be made, it should be on the side of having the surroundings slightly darker rather than lighter because of the effect of too bright surroundings in reducing the sensitivity of the eye.

Ceiling Height. The ceiling height of the room in which the light source is installed (or the height of the lighting fixture, if that is lower) has much to do with the comfort of the installation. Comfort produced by a lighting installation varies with the height of the light source above the eye. Fixtures placed at a level found to be at the borderline of comfort will become almost unobtrusive if they are raised several feet. Even bare incandescent lamps would cause no discomfort if they were mounted high enough above the reading surface. In general it may be said that as the horizontal dimensions of a room are increased, so should the ceiling height be increased, though not in the same proportion. This rule becomes less important as the design of fixtures is improved (particularly with indirect lighting which makes the ceiling a secondary source of light) to provide good distribution of light and as provision is made to protect the eye from direct rays from the light source.

The eye is less tolerant of light sources as they approach the normal or horizontal line of vision. The eye is very tolerant of the brightness of light sources 50 or 60 degrees above the horizontal. It is much less so when the angle is 15 degrees or less. It is also true that in a large room a lamp at 15 degrees would be likely to be farther away than in a small room, and it would accordingly be less objectionable. As a general rule it may be said that all light sources should be at least 18 degrees above the horizontal line of vision: placing them within a range of 20 to 30 degrees is preferable.

Incandescent versus Fluorescent. A major controversy in the contemporary lighting of libraries, schools, offices, and other large spaces revolves around the relative advantages of fluorescent and incandescent lighting. It seems to be unfortunately

true that the advent of a new illuminant is followed by widespread and indiscriminate use without proper attention being given to the special fixtures which may be required to make the use of the new illuminant comfortable and effective. When the tungsten (incandescent) filament lamps were first introduced, most of the bulbs were used bare (even as many fluorescent installations are used today) and were found to be much more glaring and uncomfortable than the carbon filament (incandescent) lamps which they replaced.

Thirty years' experience with tungsten lamps has resulted in the almost universal use of various types of shades and reflectors which hide the light source from the eye and distribute the brightness. As soon as the newer fluorescent illuminant is given the benefit of careful and efficiently designed fixtures which will properly and evenly distribute the light, and which will hide the bare tube from the eye of the reader, much more general satisfaction with fluorescent installations may be expected.[6]

Relative Cost. The first cost of good fluorescent fixtures is higher than that of incandescent fixtures, but for a given level of illumination less wiring capacity is required than for incandescent. In general, the same level of illumination may be achieved with a fluorescent installation for about one half the energy output needed for incandescent lighting. A comparative study of the cost of installing and operating two kinds of incandescent and three kinds of fluorescent installations in school classrooms has been published by the General Electric Company.[7] Careful study of these figures reveals that while a good installation of fluorescent lighting does cost more than a good installation of incandescent fixtures, the difference is not especially great when measured in annual cost per foot-candle. It takes a long time for savings in energy charges to make up for the higher initial cost of the fluorescent luminaires, especially

[6] For an approach to this problem through a study of readers' preference, see Holway and Jameson, *Good Lighting for People at Work in Reading Rooms and Offices*, pp. 12-14.

[7] *Magazine of Light*, XV (1946), 76-78.

if the electricity rate is low.[8] It should also be noted that fluorescent lighting is economical in the use of current only in situations which require it to be kept turned on continuously for long periods. There is no important economy if lights are turned on and off frequently or are kept off a good deal of the time.

Another reason for the installation of fluorescent rather than incandescent lighting lies in the relative amounts of heat given off by the two systems. For a given amount of light a fluorescent lamp uses about half of the electricity used by an incandescent lamp. The amount of heat generated is, therefore, only half as great. Since heat generated by illumination is one of the major factors which must be considered in estimating the maximum load to be carried by an air-conditioning system, the kind of illumination chosen can influence the cost of air-conditioning considerably.

Medical Opinion. This discussion of fluorescent lighting cannot attempt to deal authoritatively with the charge that fluorescent illumination is harmful to the eye, but some description of the nature of the conflict among medical authorities seems pertinent. There can apparently be no question that some ophthalmologists have been having patients who complain of eye strain after working under fluorescent light. Dr. Gertrude Rand, of the Institute of Ophthalmology, is of the opinion that eye discomfort is caused by "near ultra-violet" radiation coming through the glass of the lamps.[9]

Disclaimers of the importance of this near ultra-violet radiation from fluorescent lamps point out that the same radiation is a component of daylight, particularly of blue skylight, and in much greater quantities. This is admitted by Dr. Rand, who adds that few people are able to read for long periods out-of-

[8] In the most recent study of this subject, James M. Ketch of the General Electric Company writes as follows: "Over a ten-year period, including the amortization of the investment in equipment, the cost per foot-candle per year for the two systems is about equal, although it may vary slightly one way or the other, depending on the rate paid for electrical current." *Bulletin of the American Institute of Architects*, 1 (Sept., 1947), 88.

[9] Cooperative Committee on Library Building Plans, *The Second Princeton Conference* (Philadelphia, Stephenson-Brothers, 1947), p. 47.

doors facing blue skylight without wearing protective glasses. The controversy has not been resolved so far as the nature of fluorescent light is concerned, but authorities are agreed that complaints about fluorescent light can be avoided if the source of light is properly shielded.

Proper shielding, if carried to its logical and complete fulfilment, means the provision of indirect luminaires similar in nature to the best indirect incandescent installations now in operation. Such luminaires for fluorescent installations are expensive, but may be expected to return their investment in lower current charges and lower air-conditioning cost. Simpler installations of louvered or "egg-crate" design are possible, and are effective to the extent that they bar the direct radiation of the apparently objectionable near ultra-violet light from the eyes. However, there is still the difficulty that this radiation may be reflected from the work surfaces to the eyes. Indeed, before approving egg-crate designs, the librarian will wish to satisfy himself that specular reflection will not prove troublesome. Other installations employ lenses to provide effective distribution and stop the transmission of the non-visible components.

Stroboscopic Effect. One of the objections to fluorescent lighting is the slight flicker found in some installations. It is caused by the alternation between relative brightness and darkness as the alternating current fluctuates through the tube. Since one source of eye discomfort is a rapidly changing iris, this stroboscopic effect can be disturbing. It can in large measure be obviated by avoiding the use of single fluorescent tubes, since properly mounted pairs of tubes will not have this minute flicker. The more violent flicker which occurs when a fluorescent tube is about to burn out may now be avoided by a newly developed device which automatically takes a lamp out of service after it has made three or four attempts to go out.

Daylight. Although it is not likely that library buildings will soon be designed without any fenestration at all, daylight cannot be depended upon exclusively for lighting a library, nor should the possible use of daylight, other than for its undetermined psychological effects, influence either the interior de-

sign or the exterior architecture of the building. Windows provide in general a very inefficient and uneven source of light and must in all cases be supplemented with an adequate lighting installation. There is no objection to mixing daylight with artificial light as varying amounts of daylight make it necessary, but the provision of windows should not depend on their probable value as a source of light.

Large rooms which are lighted by daylight near the outside walls and by artificial light near the inner wall often reveal the relative qualities of the two sources of light. Where people choose to sit will depend in large part on whether the window light is too bright for comfort. Most people prefer to read by daylight if it is not too bright. It is usually better diffused and of better color quality. Though it is said to give six per cent higher speed of seeing than incandescent lighting, this is probably too small a difference to be of importance.

Proper Fixture Installation. Each library building will have an individual and distinctive lighting problem which will call for its own special solution. Both fluorescent and incandescent installations may easily prove to be unsatisfactory if improperly planned, or if luminaires are badly designed. The ideal of having low brightness contrasts calls for fixtures which achieve maximum diffusion of light. They must, in achieving that objective, avoid both the direct glare of an exposed light source and the indirect glare of bright spots on the ceiling above the fixture.

Stack Lighting. The major objective in the lighting of stacks is to provide adequate light on all the rows of books. The lower rows naturally present the greatest difficulty. Quite a number of special reflectors have been designed for stack lighting and some serve reasonably well, although there is usually a series of darker areas between fixtures. The more elongated fluorescent fixture would seem to have natural advantages for stack lighting, provided the tubes are adequately shielded. But there is the disadvantage of expensive installation and also of expensive operation when the situation calls for lights to be turned on and off frequently and not as a rule to be kept on continuously for long periods.

Carrel Lighting. Lighting for carrels is preferably designed to diffuse the whole carrel with light. Small lamps attached directly above the desk, even though adequately shielded, must necessarily violate the principle of providing low brightness contrasts. Lamps so placed are excessively subject to "tinkering" by students and do not remain in service for long. Experimental installations of single and double fluorescent tubes are shown and described in the report of the Second Princeton Conference.[10]

Ideal Lighting Conditions. This discussion of modern illumination may well be concluded by quoting the comments of Professor Parry Moon of the Massachusetts Institute of Technology and Professor Domina Eberle Spencer of Tufts College which were prepared especially for the Cooperative Committee on the basis of the Princeton Conference.[11]

Comments on Library Lighting

The Princeton discussion of library lighting, June 1946, shows a striking agreement in the principles to be used in achieving satisfactory visual conditions. Dr. Rand, Ward Harrison, and Bassett Jones point out again and again the necessity of eliminating glare sources, reducing contrast, employing low brightness ratios.

It is also agreed that

(1) Many poor installations of fluorescent lamps have been made,

(2) Fluorescent lamps must not be exposed to view because of glare,

(3) If properly shielded, the fluorescent lamp does not constitute a menace to vision,

irrespective of differences of opinion about ultraviolet emission from *unshielded* lamps.

Since the achievement of a reasonable brightness ratio requires that exposed fluorescent lamps shall not be used, the argument about the possible ill effects of exposed tubes is not germane to library lighting. One can therefore concentrate on the principles that must apply if best lighting is to be achieved. We agree with the various speakers about the necessity of reducing brightness ra-

[10] *Ibid.*, p. 64-67.

[11] *Ibid.*, p. 61-62.

tios and about the desirability of using high reflectances for walls, floor, and furniture. In fact, we go further than they do. A recent investigation at M.I.T. establishes quantitative criteria that are a further step in the direction agreed on by all the speakers at the conference.

Not only must the direct glare from fluorescent lamps (or any other lamps) be eliminated but *reflected* glare must also be abolished. This means that *louvered fixtures must never be used: the fluorescent lamps must be shielded completely* so that their images cannot constitute glare sources under any circumstances.

A second point is that the best visual conditions are obtained when lighting is produced by a *uniformly luminous ceiling.* Essentially the same effect can be obtained either by making the ceiling of translucent plastic with lamps above it, or by using dense translucent reflectors suspended below the ceiling and sending most of their light upward.

A third point is that the reflectances of the room surfaces should be much higher than those commonly used in the past. High reflectances not only reduce contrasts and help to diffuse the light; they also are economical. By using high reflectances instead of the conventional low values, one can often get twice the amount of useful light with no additional cost.

A table of specific recommendations follows.

Tentative Standards for Obtaining Best Vision

(1) Ceilings should be pure white (not "off-white") and should have initial reflectances of at least 0.80 (Munsell value 9.4).

(2) Wall surfaces (including chalkboards) should have reflectances of at least 0.50 (Munsell value 7.8) and chromas that do not exceed 4.

(3) Floors should have reflectances of at least 0.30 (Munsell value 6). Chromas should not exceed 4. The purpose of the foregoing high reflectances is to obtain

  (a) A bright, cheerful appearance for the room;

  (b) Low contrasts, to promote good vision;

  (c) A maximum of interflections of light among the various surfaces, to give a diffused quality to the light and freedom from shadows;

(d) A maximum of useful light for a given lighting system.

(4) Desk tops and table tops should have reflectances of at least 0.30 (Munsell value 6) with chromas not exceeding 4. Lower reflectances will produce too much contrast with white paper and will tend to cause eye strain. These values for desk tops can be realized by using unstained wood or by covering the surface with a light-colored linoleum.

(5) Furniture and trim should preferably be as in (4). Lower values and higher chromas may be employed, but only if the size of the object is small compared with the distance at which it is viewed.

(6) Venetian blinds should be white and should be drawn at night.

(7) Average illumination at desk level, produced by the artificial lighting system, should be at least 20 lumens per square foot (20 "ft. candles").

(8) Maximum brightness of a luminaire should not exceed 3 times the brightness of paper on the desk. Usually the eyes adapt themselves to the brightness of the paper, and any extended surface having a brightness more than 3 times this value is a source of annoyance and possible eye strain. *Even if the luminaire is completely out of the normal field of view, it is almost sure to cause trouble because of specular reflections if its brightness is more than 3 times the brightness to which the eyes are adapted.*[12]

[12] Serious exception has been taken to this 8th tentative standard by Mr. H. L. Logan of the Holophane Co., Inc., to whom reference has already been made. He objects that "specular" surfaces are not common and are getting less common every day, since manufacturers are generally cooperating to remove them from their products designed for use in the work world. But, more particularly, he objects to the three-to-one ratio as between the brightness of the luminaire and the brightness of the paper on the desk. He holds that this is highly controversial and is not proved by either biological or physiological evidence, though he acknowledges that Moon and Spencer do not stand alone in their opinion.

CHAPTER VII

TECHNOLOGICAL PROBLEMS AND TRENDS

New Materials and Methods of Construction. The building industry has an exasperating characteristic—its revolution seems always around the corner. The possibilities in new materials and new methods are so enticing that the layman (librarian) is likely to be led astray. Not all architects are reactionary—most of them will have heard about the "new" materials and techniques before the librarian has; most of them will have had a better chance to assess the merits and defects of the new proposals. By all means let the librarian become aware of new possibilities, let him even become enamored of them. Let him take any precautions which seem fitting lest his architect doze among the bricks. But when this has been done, let him be calm, let him expect no miracles. Innovations come hard in the building business and they usually come high.

The recent experience of one up-to-date institution may be illuminating. Both the administration and the architects of M.I.T.'s new library building were anxious to take advantage of every new and proved or provable technique. The plans called for a flexible building. The times were such that it appeared economically desirable to do as much fabrication as possible in the shop so as to minimize the field work. "Dry" construction was clearly indicated, both to reduce field operations and to make subsequent plan changes easier. The planning called for a maximum of flexibility, and to make this possible the vertical ducts were placed for the most part in the exterior walls. This made the working part of the outside wall a sequence of columns, ducts, and windows. In the circumstances the interior and exterior surfaces had only to be weather-skins. Finally, the foundation problem was difficult and these skins had to be kept as light as possible.

All these considerations led naturally to the selection of a dry floor system consisting of steel beams and girders and columns to support a steel-pan floor system of excellent and well-

established character; the walls were to be metal panels inside and out, buckled to the columns and beams. This scheme was taken seriously, was published,[1] and was certainly intended to be used.

However, no university library is likely to escape the final challenge of cost. When the M.I.T. building was reviewed on this score, it became clear that every possible study must be made which might lead to an important reduction in cost. One of these substituted conventional concrete floors and brick filler walls for the less usual but still unrevolutionary metal scheme proposed. The saving by using the old materials was very substantial; the promised maintenance cost could be estimated at no higher and perhaps even lower. Only one decision was possible.

This has been all too common an experience. Brick, concrete, stone, structural steel, and hollow tile are good materials. There is a wealth of experience behind their use. It may well be that contractors facing new materials and methods tend to overbid to cover uncertainties. But on the whole the soundest position for the librarian seems to be to look at the new with enthusiasm, to insist upon a design embodying it where it will serve any useful purpose, but not to be too surprised or disappointed if it turns out that cost dictates the use of the conventional. The use of old materials by no means dictates that the building shall be old-fashioned.

Efforts have been made, notably by Angus Snead Macdonald, to go even further in the integration of structure and function. As developed and as demonstrated to the Cooperative Committee in a "mock-up" at Orange, Virginia, Mr. Macdonald has provided a building of light steel columns, beams, and panels; the columns are hollow and are proposed to provide the vertical ducts for a ventilating or air-conditioning system. The air is discharged into plenum chambers or ducts provided by the metal floor system and thence into the rooms through perforations in the ceiling. The ceiling construction is so arranged as to permit substitution of flush lighting fixtures at will. Separation of rooms is provided by standardized metal panels de-

[1] "Technology Made Human," *Architectural Record*, c (Nov., 1946), 99-110.

rived from the already well developed metal-partition industry. This flexibility is enhanced by a standardized spacing of columns determined by the usual dimensions of standard library stack furniture. The State University of Iowa, under the influence of its librarian, Ralph Ellsworth, proposes to employ some such method; and Alfred M. Githens in his designs for the library at the University of Georgia has proposed his own adaptation of the same ideas.

The hypothetical advantages of such an approach are apparent; certain potential disadvantages related to possible noise and fire risk, and more theoretical than real flexibility, have been discussed by the Cooperative Committee. On the evidence now available, it is impossible for the writers to take a position of approval or disapproval. It is highly desirable that the method be tried on full scale, and any such trials should be observed with the greatest of attention. Immediately profitable application of the specific Macdonald combination is more likely to be achieved in a small than in a large library building, for the large building repeats itself often enough to create its own standardized parts, while the small building, to attain the same economy, must use the same standards as are employed in other small buildings so that in toto the quantity of material used approximates that of the large complex.

Designing for Flexibility. Whether or not so complete an integration of diverse engineering function as proposed by Macdonald is achieved, the fact is clear that all library buildings are moving towards a greater flexibility of layout, permitting change, and often drastic change, of space use as measured by shape and size, change which may be made some years after the building is first occupied. The materials and construction methods do have some bearing on the potentials for flexibility, though perhaps not so dominating a position as would seem probable. When we speak of such flexibility here, we refer to major changes of use to be undertaken only after serious consideration, and not overnight or between-class flexibility such as might be provided by sliding partitions. The long-range flexibility will never be achieved without some effort being attached to each change; for even perfectly demountable materials re-

quire some work to demount and remove if they have rested in one position for several years and have been subjected to the action of building settlement, corrosion, and humidity change.

This flexibility can be obtained both vertically and horizontally. The latter is both easier to secure and more important, as it imposes but few limitations on the floor structure to be selected. Vertical flexibility may sometimes be desirable, however, and is worth a short consideration.

The need for vertical flexibility will probably seldom arise all over a building. It occurs when a floor area can be conceived of as needing to be so large that a relatively low ceiling such as is suitable for a smaller room will not suffice and when it is not determinable in perpetuity that the assigned area will always be of one general dimension. The maximum approach to this would doubtless be to arrange floor systems which could be as demountable as standard partitions. Thus, if the room were to be 7′ 4″ in the clear and the floor system 3″ thick, removal of a floor would produce a ceiling height of 14′ 11″, and removal of two floors, a ceiling height of 22′ 6″. Such flexibility can be provided so far as engineering skill is concerned but only at high cost. Moreover, it will be mandatory to use a dry system, for the cost of removing concrete structural floors is prohibitive. Since rooms as high as 20 feet are largely out of fashion, one of two compromises is possible. The first compromise, typified by the building at Princeton, simply asserts that a single standard ceiling height of 8′ 4″ is adequate for all or almost all rooms in the building and that it is possible to predetermine the size and location of any and all other rooms which need a greater ceiling height. This makes the horizontal separation provided by the floors a permanent thing and makes the choice of floor structures independent of the need for vertical flexibility. A similar compromise was accepted at first at the University of Iowa, but it is now planned to use removable floor pans which will make it possible to achieve a two-story effect within any one module or line of modules simply by removing the pans and covering the bared structural elements.

The other compromise is that planned for M.I.T. Here, permanent floors, where again the construction is not a criterion, are separated by a net height of approximately 15 feet. Col-

umns are so arranged as to permit the insertion of demountable (steel) mezzanines anywhere in the building to provide two floors each from 7′ to 7′ 4″ in the clear, allowing 4″ for the mezzanine construction. Each has its advantages. The lower ceiling heights of the M.I.T. plan are somewhat less attractive, though ample, as can be seen by visiting the Houghton Library at Harvard or the Library of Congress Annex.

The question of adequate ceiling height is one on which the Cooperative Committee has been unable to come to decisive findings. There is some evidence that as the room gets larger in floor area the ceiling should be higher if only because of the light fixtures. Ventilation is also a problem; excessively low ceilings, especially in closed rooms, make draftless ventilation almost as difficult to achieve as glareless lighting. But what the correct relations are is hard to determine. It seems clear that ceilings can be substantially lower than most imagination would concede or than would be dictated by elegant proportions. In the last analysis much will depend upon the colors, the light sources, the furniture, and the use to which the spaces are to be put. It will be interesting to observe whether the rather low ceilings of some of M.I.T.'s rooms are not happier, juxtaposed as they are with higher-ceilinged areas, than the repeated uniformly ceilinged rooms of Iowa, each higher than the low ones at M.I.T. but none so truly spacious as the higher ones in the same institution. The two buildings will soon give the librarian a chance to make his own choice.

This much does seem to be agreed upon, that 7′ 3″ will do for many work spaces but that the 6′ 11″ occasionally encountered, for example at one place in the Houghton Library, may be a trifle on the low side; that 8′ to 8′ 4″ will be comfortable for most purposes if not all, although a little inefficient in that the top foot is not too useful for active book storage; and that no room needs to be provided in a modern university library which is otherwise so monumental as to require a net ceiling height in excess of 15 feet, and in fact such rooms are undesirable.

Horizontal flexibility is limited only by expense. The maximum flexibility would be provided by an arch or suspension system by which the entire floor expanse of the building would be supported at or outside the exterior walls and in which

every square foot of floor was engineered to carry loads of books or people indifferently. This would be quite impracticable for most buildings for economic considerations and the flexibility would be diminished from its hypothetical total by the necessity for fixed positions for elevators, stairs, and ducts. It might be very difficult, moreover, so to arrange the ducts as to permit adequate discharge of air and light into any and all spaces which the librarian might decide to create by moving partitions around. More practical approaches are again two in number. Both require a floor-supported stack instead of the self-supported stack; the latter, of course, imposes a considerable handicap on full flexibility.

One approach provides flexibility by completely repetitive column spacing on a relatively small module. In this scheme the larger rooms have perforce to see their floor areas obstructed by some free-standing columns, but there is a good deal of evidence to suggest that a considerable number of these can be tolerated without much distress. With columns as close together as 10′ on centers, for example, a room 20′ x 60′ can be provided with only one row of columns down the center, while two rows of columns will permit a room 30′ x 60′, 30′ x 80′, 30′ x 100′, etc.

The other approach, achieved at somewhat but not much greater cost, is exemplified in the M.I.T. building where the widest economical column spacing (though not the cheapest) was adopted. This provides columns on 31′ 6″ centerings and permits an obstructionless room 31′ 6″ by any length up to 270 feet. Such a solution is more urbane if the library is to have any large rooms and less important if not.

In either case, channels of vertical communication for people, books, air, water, and electricity should be concentrated into the minimum possible number of fixed cores and then the only other limitations on flexibility of floor layout will be imposed by the outside walls, the column centerings, the problem of ventilating the planned spaces, and the means of circulation of people from one space to the next. It will be recognized that all these, plus the cost of change, impose serious limitations on total flexibility.

Indeed, it has been argued before the Cooperative Commit-

tee that full flexibility may mean the capacity to do everything in one way or another but nothing very well, and flexibility should not become such a fetish in library planning as to inhibit superior performance of any clearly definable library task; on the other hand, it is reasonable to sacrifice some construction economy to permit one's successor to reorganize the library.

It costs more, for example, to make a floor designed for a reading area strong enough so that it can someday support stacks than it would cost to consign it in perpetuity to the lighter loads of the reading room. At M.I.T., designing everywhere for the greater load was estimated to increase the cost of the building by one per cent and the investment was regarded as judicious in the main part of the building.

Within this framework the selection of vertical partitions offers wide freedom of choice. If walls are to be moved frequently, demountable steel partitions may well be the answer; in this case the building should provide storage space for unused parts. If moves are to be infrequent, attention may reluctantly be paid to the inelegant but conventional hollow tile and plaster wall or to cinder block, which, imaginatively painted, can be very attractive, as has been demonstrated in the new library at Princeton. At least two moves will apparently be required before the re-usable steel wall will be economically competitive with the expendable tile and plaster wall. The tile and plaster wall will provide somewhat more solidity and fire resistance, and be a better sound barrier from room to room; it will be dirtier to remove and replace. No generalization can, in the light of these facts, be made.

Next to columns and to the cores embracing vertical circulation, power, and ventilation, the fenestration of the building is most likely to threaten the flexibility of the plan. There are at least three solutions to the problem of window spacing which suggest no such threat, and each deserves some argument.

It can be stated rather categorically that no library building in the United States can place full dependence upon natural light for all its illumination—even if the whole surface of the wall were to be of glass and even if the building were a narrow

one facing north so that the windows would never have to be shaded against glare and so that the distances from the windows to the farther wall were slight. In more normal situations it is inevitable that there will be substantial areas which cannot be lighted by natural daylight even at high noon on a bright day.

Once this is admitted, certain corollaries may follow. It seems well established that it is very hard so to combine natural and artificial sources of illumination that the latter may provide uniformity against the fluctuant nature of the former. Many can therefore be found to argue that conventional window spacings based on different needs and different solutions are entirely illogical for a library building of today; the conclusion naturally enough is drawn that the library should have no windows or that its walls should be entirely of glass.

The windowless library has much to attract the logical mind. Walls in such a building offer less of a problem in controlling temperature losses which are, quite aside from operating cost, important where humidification is being provided. Solid walls should be somewhat cheaper than walls which alternate glass and other materials, and may well serve as a better barrier against exterior noise. Modern methods of lighting and ventilating, plus modern skill in the handling of color on walls and ceilings, have amply demonstrated that windowless areas can be very pleasant places to inhabit and in which to work. The cry of "claustrophobia" does not seem to be supported by any serious technical evidence, nor do the night habits of scholars and the behavior of persons in many other windowless spaces lend much credence to the idea that the fear lest someone suffer claustrophobia is anything but a defense mechanism to protect long-established architectural mores.

Some architects have argued before the Committee that it is physiologically necessary to rest the eyes by lifting them from the book and focusing them through the window on some far-distant scene. Again, the formal physiological proof has not been presented and the exponents of this point of view are themselves able to work for hours in a Pullman bedroom or roomette at night with the shades drawn.

Finally, it can be argued that windows should be supplied so

that the occupants of the library shall not be deprived of beautiful vistas. Assuming that these are potential in the site of the library, whether or not the handicaps imposed by ordinary windows should be suffered in order that the library user's eye may roam from the book to the pleasance and back clearly involves a question of psychology and taste which it is beyond the capacity of this monograph to resolve.

It can be concluded, it appears, that no modern library should be provided with windows without serious consideration as to why they are being provided; and, above all, the customer should assure himself that the reasons advanced are the real ones and that they are valid. It is not possible to indicate any important existing library which is windowless, but the library builder can find several other building types to inspect and can also look at individual rooms in libraries, such as the Butler Library stack at Columbia, which is a very large windowless space. These may give him pause in a decision to supply windows to his building. On the evidence, the burden of proof should rest on the person who opposes the windowless building and not on the one who supports it.

It has to be admitted, however, that we tread here on unknown psychological ground. Many modern architects who would accept practically all the arguments for the windowless building balk at the final conclusion because they feel that the human occupants should not be deprived of the stimulus of sun and view. Nonetheless, they dislike the alternate pools of glaring sun and darkness which result from windows alternated with solid walls. Their proposal, then, calls for a wall of glass.

This solution has a great deal of merit. On the north wall of a building north of the Tropic of Cancer there is perhaps nothing to say against it and much to say for it. North light is good working light; modern double glazing need not encourage fear of condensation or undue heat loss. Glare should not be a problem.

But the case is different for walls with eastern, southern, or western exposures. Here it will appear at some times of day and in some seasons that the glare of direct sunlight penetrating the work spaces becomes intolerable. In buildings which have great areas of such walls, fairly complicated expedients

have been resorted to in order to make the window areas tolerable at all times. These are often very exciting aesthetically, but before embracing them the library builder should look at them carefully for all of them have not worked out so well in practice as paper considerations might suggest.

In dealing with southern and western walls (and to a lesser degree with eastern) it will be well to remember that not everyone likes the sun; that the latitude and the annual amount of sunshine have a great deal to do with how people crave it; and that sun is almost certainly more useful for recreational than for studious activities.

It would appear that either the windowless building, or the all-glass wall with glare controls, or the building with great glass areas on the north and none on the south, or even the building with full glass on the north and horizontal strip windows on the sunny sides (since the glare controls for these are simple)—that each of these is entitled to the fullest of consideration before the timid soul turns to the usual solution which, like most compromises, succeeds in attaining nearly all the disadvantages of the alternatives but only a part of their advantages.

The usual solution is, of course, that of placing the windows on some sort of uniform centering or series of centerings such as is customary in almost every past building and is still to be found in almost all the new proposed library buildings which have come before the Cooperative Committee.

Although, on all the grounds cited above, there is fair reason to question whether windows belong in the library at all, or if they do, whether they should be separated by any solid walls, it is still possible to use conventional windows without too much limitation of flexibility. This can be achieved, however, only if the module has determined the window spacing and not the converse. It has to be recognized that the spacing of Renaissance, Georgian, and Gothic windows was quite different. If the first decision about the library is that it is to be Gothic, for example, and if the architect is a sincere and learned Gothicist, there are some limitations to what he can then do about window spacing. The same thing applies to other styles. Façade architecture, archaeology, and nostalgia will not necessarily

produce window sizes and spacings which defeat or limit flexibility, but they do have that potential. If the librarian has to have repeated windows, let him look to their spacing and be firm that style shall not prevail over greater needs. Many existent buildings demonstrate that in insisting on this he is not asking the impossible, since first-rate architects are capable of achieving both desiderata.

Noise Control. Traditional signs importuning "Silence" in library reading rooms are approaching a well-deserved extinction as librarians realize that some conversation is important to the routine of study, and as modern acoustical engineering perfects its techniques for controlling noise. Except for the widely held belief that libraries should be quiet, there is little information about just how quiet they should be. McDiarmid and Tatum's study of "Library Noise" at Baylor University[2] describes the various noise levels at one institution, but does not venture a comparison with what ideal conditions might be.

Those ideal conditions are at present unknown. Most persons agree that a room can be too noisy. Many fewer are of the opinion that a room can also be too quiet. It is true, too, that if there is no variation in illumination, ventilation, and noise level, a perfect condition for sleep is induced—provided, of course, that illumination, noise, and temperature levels do not approach the threshold of pain. There is a risk that the student will fall asleep in a non-mobile environment, no matter how intent he may be. We have achieved desirable and acceptable standards for lighting and ventilation, but have as yet no objective idea of how quiet a library should be. Certainly it is true that the art of soundproofing between rooms and the reduction of resonance within rooms is much further advanced than our knowledge of the conditions we need to achieve.

It is possible that libraries have been too quiet. This is not necessarily bad in itself, but it creates a psychological effect of entering on tiptoe. Actually, one should enter a library lustily. It must also be recognized that group study makes it desirable for people to talk with each other about material in many places in the library.

[2] *Library Quarterly*, VIII (1938), 200-9.

McDiarmid and Tatum classified library noise into two categories: background noise and service noise. Background noise is composed of street noises, noise of birds and insects, constant noise of electric fans and ventilators. Little can be done about controlling such noise—except that portion which comes from outside, which may be materially reduced by installing double glazing. Such an installation presumes complete air-conditioning, for it would be ineffective upon opening of a window.

Service noise is produced by the normal use of the library—walking, talking, moving of chairs, card catalogue trays and other equipment. It can be reduced by providing sound-absorbent surfaces on walls and ceilings and by eliminating the hard surfaces that cause contact noises. So much is obvious—perhaps too obvious. Each room of a library should be acoustically studied by a competent engineer who understands the purpose of the room. Rooms where talking or musical reproduction is contemplated should be "live" rooms where sound will flow pleasantly and unobtrusively. Rooms intended to have a certain level of quietness will receive different treatment, and this fact will often affect shape of space and form of walls as well as materials used on the enclosing surfaces. The important thing here is that the librarian provide some administrative decisions, then have the solutions made by the acoustic engineer, and finally stand squarely against any emasculation of the acoustic treatment in the name of aesthetics. If the alternatives are sharp and definite, the librarian can readily enough select his answer; the difficulty arises in more fuzzy situations for which, however, the same principles should prevail.

Vertical Circulation. All library buildings require the installation of elevators for transporting books and other materials from floor to floor. One such service elevator is desirably located in the stack area, and another near the receiving room and processing departments which will usually have a vertical relation to each other. Elevators may also be the only acceptable solution to public and staff vertical circulation, but the modern escalator has so many attractive features that it should

not be rejected without careful consideration. Escalators unfortunately become economical and efficient only when they serve rather large floor areas or when the vertical traffic is fairly heavy. Traffic within a library may not be heavy enough at all times to justify escalators, but hourly peak loads may make them economical and desirable. Certainly they should be seriously considered in every large library and rejected only for cause. The "Pater Noster" which has been popular in Germany will probably not be accepted here even for staff lifts.

Adequate provision for stairways must be made as well. Local building codes will provide some direction on the frequency and location of stairways. In addition, good library practice indicates that stairways should not be more than 100 feet apart, so that a reader wishing to go to another level may never need to traverse more than 50 feet to a stairway.

Floors. Basic floors in new library buildings will in most instances consist of concrete or steel, depending on the type of building construction. A variety of floor coverings or surfaces may be applied to either of these basic floors, all of which have peculiar advantages and disadvantages of first cost, cost of maintenance, appearance, durability, and noiselessness. Some years ago the American Library Association published a table on floor coverings which is not reproduced here because it should be used only for the most general and preliminary guidance.[3] First-cost figures fluctuate and the 1939 figures surely are no longer valid, while several of the other ratings given have been strongly challenged. The ratings as to appearance, for example, are clearly subjective and would not find general acceptance, but even the more measurable things such as durability, maintenance, and noiselessness have not been thoroughly measured, and about the ratings experts would disagree.

[3] Cornelia D. Plaister, *Floors and Floor Coverings*, Chicago: American Library Association, 1939, p. 9. See remainder of this pamphlet for details of specifications, maintenance, and manufacture.

A much more extensive analysis of floor coverings was made by the United States National Bureau of Standards in connection with low-cost housing experimental programs. The values would still be pertinent to library construction as the discussion hinged upon public housing and not individual dwellings. The following reports will probably be of interest: BMS14, BMS34, BMS48, BMS68, BMS78, BMS80, BMS85 and BMS100, all obtainable from the Superintendent of Documents.

If the librarian will state his requirements and then with architectural advice select materials which approach both the engineering and the human requirements, better results will be obtained than if he tries to find a panacea from any table ever published.

The things which one will study in selecting the floor system are durability, maintenance requirements, comfort, noiselessness, appearance, and, of course, cost, both prime and continuing. A comfortable floor will feel good to walk upon, will not act with the shoe to generate static electricity, and in the stacks will reflect light to the bottom shelves. A floor which is silent under the impact of a wooden sabot may squeak under the friction of a rubber sole—and so through a long series of considerations, all comprehended in the experience and training of the architect, comprehended only partially and erratically in the experience of the librarian.

Micro-Reproduction. Even though microfilm has achieved an important place in American libraries, particularly for bulky materials (newspapers) and those otherwise unobtainable, experimentation with film and other forms of micro-reproduction is a continuing process. Libraries being planned today may expect to provide space for new and improved devices and techniques about which nothing is now known. The present unpopularity of microfilm with scholars may be expected to be overcome as need increases, as reading machines are improved, and as certain materials which are not well adapted to microfilm in rolls are microfilmed on sheets.

Already in production is the Readex Microprint, an edition process which prints a greatly reduced facsimile of books or other documents on paper. Reading is accomplished with a special machine (Readex) which projects the reduced facsimile on a translucent screen. A committee of librarians is currently studying an adaptation (Microcard) which would reproduce the text of a book on the back of its own catalog card. Seemingly in competition, microfilm and microprint may both be expected to develop, for they serve two somewhat different purposes. Microprint, particularly, being an edition process whose cost per copy goes down as the number of copies pro-

duced goes up, may under favorable circumstances constitute serious competition to books as we know them today. The possible influence on libraries and their problems of administration and storage may be much more significant and far-reaching than is now apparent.

Visual and Aural Aids. The growth of teaching in the library as described in these pages and the development of methods other than printing for the reproduction of the human record will bring into the library many existing and still-to-be-perfected visual and aural aids. Provision for sound motion pictures, lantern slides, musical and voice recordings, are among the more obvious. The list of visual and aural aids projected for the Heritage Library of the University of Iowa has already been commented upon.[4] At Princeton the architects suggested the installation of translucent plastic relief maps as wall fixtures and the use of various types of maps reproduced on film slides, but this interesting proposal would doubtless involve too great a financial burden for any single library and could only be produced on an adequate scale by a commercial enterprise. Wire recording and television are already in the foreseeable future. Other devices, as yet unknown, are sure to find their way into instructional procedures and library buildings.

Inter-Library Communication. Branch and departmental libraries are normally connected by telephone so that information about books can be immediately available at any point in the library system of a large university. The pace of scholarship has not usually been so hurried, however, as to have caused the introduction of a system to make books as quickly available as the information about them. But such a system is not impossible. Its existence might serve to alleviate some of the objections to branch libraries as well as to central storage of less active branch-library materials. Pneumatic tube systems can deliver books to and from any point in a library system as quickly as they are now delivered from a stack to a charging desk. However, it must be acknowledged that such installations are extremely expensive.

[4] See above, Chap. II, pp. 27, 84.

Intra-Library Communication. Book conveyors will continue to be useful for the vertical circulation of books in flexible library buildings now being planned, for the central charging desk may be expected to remain permanently located. Horizontal conveyors may, however, be difficult to install in libraries with low ceilings and large areas devoted to both stacks and reading space. Pneumatic tubes may be the solution here also, especially in buildings with greater horizontal stack areas than can efficiently be handled by pages.

Call-slip transmission, if the slips are actually to be transmitted, will continue to be effected by pneumatic tube. Where transmission of the call slip is not required, the telautograph has been used with success, even though somewhat subject to inaccuracy through hasty and illegible writing. A more satisfactory solution will soon be forthcoming through improvements in techniques for facsimile reproduction. This method will allow the almost instantaneous duplication of the call slip at any one, or more than one, station in the stack at which instruments are located. The reproduced call slip, already complete with the name and address of the borrower, can be returned to the charging desk with the book and be integrated into the charging system, probably eliminating the need for using book cards in the charging routine.

Rapid Selectors. Rapid selectors are already in use in American libraries to perform a variety of administrative and some research functions. Three types may be mentioned: the McBee Keysort system, used in circulation work at Harvard and Brown Universities; the punched-card (Remington Rand-Parker) system used for circulation records at the University of Virginia; and the punched-card (IBM) system used for circulation and accounting at the University of Texas and at the Montclair Public Library. Both of these latter institutions have conducted experimental research of the "Who Reads What" variety with the punched card derived from the circulation routine. The punched card has definite labor-saving advantages in library administration, and its use may be expected to spread.

The application of rapid selectors to the reference function of

the library is more difficult. This is so not because of the limitations of the existing equipment, or of equipment now capable of being designed, but because of the difficulties involved in punching or otherwise keying the proper information into the record. Every book contains material on as many subjects as its index, or worse, as the index ought to have. No contemporary cataloguer seeks to bring out more than a fraction of those subjects because of the labor and cost involved. Yet this labor and cost would not be decreased were our libraries reduced to the contents of a single desk as envisioned by Dr. Vannevar Bush.[5]

Difficult and costly as such a project might be, it has a fascination which has led at least one librarian to discuss it seriously and with imagination;[6] but the possibilities which have been described will hardly impose upon the library planner of today the obligation to design his building in the light of such a potential development.

[5] In "As We May Think," *Atlantic Monthly*, (July, 1945), 101-8.

[6] J. E. Burchard, "The Wreck of Matter and the Crush of Worlds," *Technology Review*, XLIX (1946), 28, 64-65.

CHAPTER VIII

THE LIBRARIAN AND THE ARCHITECT

THE architecture of American universities, as a whole, is notoriously reactionary, possibly the most reactionary in the nation, not even excluding ecclesiastical buildings for which there is much greater psychological excuse. As compared with the architecture of secondary schools, for example, it can almost be called shameful.

Our campuses abound in classrooms which are ill-lighted as compared with those provided for infants, with housing which is archaic and romantic even as compared with the housing of the parents, and with libraries which refuse to work. In so far as these results are due to the continued use of buildings of the past, buildings noble in their day, they can be condoned, and in the name of tradition even admired. But when tradition is unnecessarily perpetuated today in new buildings, there is room for the suspicion that something is distressingly wrong.

It is a strange nostalgia which has pervaded our campuses, strange because those responsible for it—trustees, donors, administrators, alumni, architects, and even faculties—are the very persons who by their education and experience should be most aware of how the nostalgia has come about. Those responsible are for the most part personally familiar with the European tradition—they have seen with their own eyes the monuments of Western Europe which they have tried to reproduce on the mounds of Boston, the coastal plains of Princeton, the lake flats of Chicago, the pine barrens of North Carolina, the mountains of Colorado, and the undulating hills of the Pacific Coast range. They must have realized as they observed the monuments of Europe that a great portion of their charm lay in their relationship to the time when they were built. For of very few individual buildings, such as the Parthenon or the Cathedral of Chartres, can it be said that they are so exquisite that they can be viewed in the abstract and as isolated phenomena. For the lesser but still magnificent monuments of the

past, much of the enjoyment rests in their juxtaposition to other buildings of other times, some the more, some the less noble, but each honest in its own right. This is the pattern of the English university and no American campus can lay claim to comparable aesthetic satisfactions.

Thus in this nation for the most part we have Gothic universities and Greek universities and Renaissance universities and Georgian universities; and it is rare indeed that one can find on one campus an integrated story of the growth of the university in time.

It was not ever thus. Older institutions, such as the University of Virginia, may owe their charm to a single brilliant concept such as that laid down by Thomas Jefferson. But more, like Princeton and Harvard, show for a period of years coming down rather near to the present a series of changes in the habits and thinking of Princetonians and Harvardians. It is not possible to say, save on the purest grounds, that Nassau Hall, an undoubted masterpiece, more befits the campus than Reunion Hall which, less distinguished, still adds life and color.

It is hard to say when this freezing began. Surely the University of Chicago, which raised its Gothic spires full-panoplied but not from the head of an architectural Zeus, had much to do with subsequent trends. Today at any rate all concerned are reluctant to take a chance on breaking the ice. In the face of all the experience of Europe our arbiters of university taste merely argue the risk of placing "incompatible" buildings near one another. So the tradition is perpetuated.

There is of course some risk. In any given period the manners of the people and their expression in art may be less noble than in some previous period. It is almost inevitable that the art expression will appear so to contemporaries and especially to educated contemporaries. Of course if a university follows the current fashion it will end with some good and some bad buildings, some beautiful and some ugly. But its campus will have life; and at the time when the buildings are built, at any rate, they will serve the current needs to the full of their bent instead of inhibiting a full satisfaction of those needs. Only an ostrich could suggest that the predetermination that a building shall be cast in the mold of the Greek, the Romanesque, the Gothic,

or the Renaissance can fail either to inhibit the full performance of the building or to result in an emasculation of what was noble in the earlier style. This is implicit in the meaning of the great styles. Most likely the buildings will not be good either functionally or stylistically.

It is indeed ironic that the very men who are so bold in their adventures in industry, in research, and in education should be so timid in their adventures in architecture; that people who firmly believe that today's men are superior to men of other days in such matters as science, mass education, and mass production should think the same generation inferior in matters of art; that the young to whom so many brave and important experiments in science, engineering, law, and medicine are entrusted should be considered incompetent as interpreters of their time in building.

The foregoing may be construed as a plea for "modern" architecture on our campuses and especially in our libraries. This is not so, for several reasons. In the first place, the Committee would be quite unable to agree on the canons of contemporary aesthetics—there are as many tastes among us as there are among our trustees, our administrators, our alumni, our donors, and our faculties. There are as many who are timid aesthetically and as few who are bold. This essay is not a prescription for "modern" architecture for the university or the library.

Such a prescription would in any event be impossible to write, for there is no such thing as a "modern" architecture. Wright, Le Corbusier, Gropius, Aalto, and Mies van der Rohe are, for example, all properly called great modern architects. Yet even a lay discrimination can discover that the buildings of these men have strong individuality and but few principles in common; and these principles are precisely those which have governed all important architecture. Moreover, all of these men are now middle-aged or older. Their younger contemporaries already have different expressions. The plea is not for "modern" architecture but for "contemporary" architecture.

Now "contemporary" does not simply mean everything which is built in the present day. Each great style of the past, including those we try to copy, had certain basic assumptions. We do not attempt to reproduce the Great Hall at Karnak for

the simple reason that, no matter how beautiful it may be, the close columns make the space unusable for any contemporary purpose. Until air-conditioning and modern lighting offered a new opportunity, we did not use the windowless or almost windowless walls of the Greek temple, because we needed windows where the Greeks did not. We do not even attempt to utilize the brilliant stone structure of the Gothic because structural steel is more effective for our purpose (one may wonder what the Gothic builders would have achieved with steel—not a Gothic building as we know it, one may be sure).

What we have chosen from the older styles is their external aspect. This aspect, too, is sensitive. Surely one reason why no Gothic building in America approaches the nobility of its European progenitor—no matter how faithfully the proportions, the buttresses, and the finials have been duplicated—is because it lacks iconography. We, in an age when everyone can read, have neither the interest nor the power to reproduce a sculpture which was the book for the illiterate man of the Middle Ages.

The trouble rests here. Certain proportions, of the whole, of the masses within the whole, and of the relation of voids (windows and doors) to solids, are essential if one is to recapture any of the appearance of the original. These relations inevitably impose limitations on space arrangements. It is hard, if not impossible, within the limitations of any of the parent styles to provide a large windowless wall or a large area of glass—yet either may be demanded by the plan.

In general the limitations of the historical styles are less as they are more recent. The Georgian is on the whole more easily accommodated to the contemporary building than is the Gothic, because of window proportions among other things; the Greek is still less easy to accommodate because of the imposition as a rule of axial symmetry; and the Egyptian, as has been pointed out, is already recognized as impossible.

What happens of course is that the predetermined style is stretched to the utmost to accommodate the program, whereupon it becomes a pale image of its erstwhile nobility; when no further stretch is possible the program is distorted from there on. It is time to cry halt!

This is not an essay on contemporary aesthetics, but it is necessary to state this much when talking about libraries because no type of university building has suffered more from the ministrations of "architecture." Traditionally, and we think appropriately, the library has stood as a symbol of the cultural heart of the university, and as a symbol everyone has (again with propriety) insisted that it have a nobility of architectural expression over and above that which might be required for the rest of the campus. Traditionally, and again fortunately, such a building has attracted the attention of donors. All of these circumstances lead to a prominent position and a prominent (and conservative) architecture. Our campuses are littered with libraries which have beautiful shells and which at every turn impede the efforts of the librarian to make his institution a living force in his contemporary university community.

Such buildings cannot be altered save at great expense, can seldom be expanded at all, and in no case, since they were perfect of their kind, can they be changed without serious detriment to their only claim to distinction, that of superficial beauty. Where such situations exist it is best for the building to be converted to some sort of a campus Pantheon and to let the library go its way elsewhere. This is precisely what has been done at the University of Virginia and at Columbia. Such a proposal would not be at all out of place for many existing university libraries which have been visited by the Committee.

It is all too easy to blame these results on the architect, but this is very much less than fair. A large number of these buildings were distinguished in their day, measured as libraries, as well as measured by an aesthetic standard. They were more often than not the result of a harmonious opinion between a great architect (for his day) and a librarian whose program was vastly simpler than it can be now. There is nothing we can do about these existing monuments. What we can do is to recognize the changing responsibility of the library and not limit fulfillment of this responsibility by clinging to forms which we know will not work today, no matter how distinguished they may have been in their time.

Now all this is of importance to the librarian because it indicates that he must precipitate himself into the problem of his

building at a very early point—in fact at the time when the architect is selected. Here it may be helpful to indicate the nature of various types of men who practice architecture.

At one pole are the very few men who, if not geniuses, are close to being so. If such a man is selected, the librarian should reconcile himself at once to the fact that he will have almost nothing to say about his building. Neither for that matter will the trustees nor the donor. One cannot and should not clip the wings of a Frank Lloyd Wright. Such men do not collaborate. They will study the problem carefully, they will draw their own conclusions, they will design a building of very special quality. The building may become a great adornment to the campus; it may even become a great library. Almost certainly the librarian when he first tries to use it will be appalled. He may find with time that he was quite wrong and that the genius has accomplished things far beyond the librarian's imagination; or he may find the building a total failure. The odds are on the first result, but the result is not a certainty. Since few architects are geniuses and since few administrators or trustees are bold enough to risk all on genius, this alternative will not often be elected. When it is, it should be elected with a whole heart and no crippling reservations should be imposed. It is surely in the national interest that every university be thus bold upon occasion. There are not enough geniuses nor is there enough administrative courage to permit this to be the universal solution to the dilemma.

At the other pole are the considerable number of architects who hold that their entire duty is to give the client exactly what he asks for. This type of man is likely to be a comforting one for the librarian to work with for he offers no opposition. Since librarians are not architects, and since librarians are not omniscient even about the working of a library, the result of such a marriage, free from strife as it is likely to be, is almost certain to be a weak, unattractive, and even inefficient, offspring. The Committee has observed few men among its members who are competent, as librarians, to carry out a program unchallenged, with the expectation that the building will even be good, let alone great. And there is the further danger that such an accommodating architect will leave the librarian at

the mercy of trustees or donors who "know" exactly what they want, in which case the resulting building will be even less satisfactory.

In the middle rest the group of architects with whom most librarians will have to deal. These are men of experience and competence, able to study a program as well as a style, men of conviction and force. They in turn will be of two types. One type which should be avoided will be in the group which insists that a good architect can work in any style.

This idea should be resisted. If Wright could be persuaded to design a Gothic building it would probably be the worst Gothic building in America; if Maginnis could be persuaded to work in the manner of Le Corbusier he would probably produce the worst modern building in America. An architect who is to be skilled in the work of a period, even the contemporary period, has to be deeply understanding about it. Not every eclectic architect can do even a passable design in all the historic styles. The man most sensitive to a particular bygone style may be very insensitive to the working needs of a contemporary library. If one is finally and unfortunately to insist upon Gothic, Renaissance, or Georgian, he should by all means find a firm which first has demonstrated its alertness to contemporary needs and then which is, if possible, saturated in the period desired. Such depth of saturation in all periods is simply not possible for any man or firm of men. Buildings produced by architects who seek to be all things to all men will be undistinguished no matter which aesthetic language the ventriloquist essays to use. The work of first-rate architectural firms in all but the most modern forms can be extensively surveyed before the architect is selected; informed opinion can be obtained as to the true understanding of the architect of the period which has been selected. If, for good or ill, a period is selected, the field of selection of the architect becomes, for the wise administrator, limited as well.

If the building is to be "contemporary," the problem is more difficult. Informed opinion is harder to come by. Examples to see are less common. But both do exist, and among the modern architects themselves remarkable fairness will be found in advising as to the man best suited to the particular problem.

It is for these reasons that the librarian should take an active hand in determining the general style of the building long before the architect is selected.

Other considerations will of course arise. We refrain from any comment on those which are political or social in their nature. Often they are the prevailing ones. That they should not be the prevailing ones is obvious, but human nature does not change much. All that can be said is that the librarian should resist with such strength as is in him, to the end that first things come first in the selection of the architect.

There are, however, other "first things." Wherever possible a local architect should be employed. He will almost inevitably be less expensive than a man from out of town. If competent, he should have the advantage of local knowledge as to materials, builders, labor, codes, and community habits, information which is all-important in the creation of a good building. All of these things can be studied by a competent man from away, but only as a matter of special study and at the cost of the client. The ability of the outside architect must be markedly greater than that of the local man before he can overcome the disadvantage of being a stranger.

One very important point is to make sure that the architect is candid with the client and himself as to what can in fact be built within the funds available. A common disastrous experience not at all limited to the present unsettled times is that the librarian and the architect bring forth an original building plan far beyond the resources available or even potential. Occasionally the building is driven through regardless of the deficit, of course at the cost of a distorted campus building program. More often the building design is subjected to a series of compromises. The effect of these compromises is unpredictable. Sometimes they result in such close study that the final design is far better than the optimistic first presentation. More often, perhaps, they result in diminution both of the program and of the stature of the building.

An experienced architect should be able to determine well in advance whether the program for the building is quite unrealistic in the matter of cost. It is perhaps too common that even with this experience the architect "plays along" with the

client in the vague hope that some way out of the dilemma will be found. The most honest architect will state the situation in a forthright way at the beginning and everyone will be happier thereafter. Whether or not the architect under consideration has this degree of frankness can be determined only by discussing him with former clients. This procedure is not followed often enough.

In general, architects are not specialists. A few have made a specialty of domestic architecture, a few of industrial buildings, a few of schools. A smaller number have designed numbers of hospitals or churches. One or two firms are looked upon as library experts. The Committee does not find any dominating reason why an architect should be employed because he is a "library expert" and indeed thinks the evidence points to the fact that competent firms will do quite as well as or even better than "expert" firms. Thus, while experience in this field is an asset, it is less important than skill, imagination, cooperativeness, and integrity; and it is by no means a sine qua non that the firm has ever designed a library before.

Architectural competitions are sometimes employed for the selection of the architect. The Committee does not look upon these with favor. Architectural services cannot be purchased for nothing. The winner of a competition is not necessarily the best architect to do the building. The approval of a design in competition drawings is likely to set up a target for the final building which is hard to escape when later consideration shows it to have been unwise. A university can seldom afford the "invited" competition in which a number of leading firms are guaranteed substantial fees for their participation in the competition, and leading firms will ordinarily not participate on other bases. Save as a way to obtain publicity and to raise funds, the competition has little to recommend it. Its benefits even in this area are likely to be illusory. It seems better to pick a good horse and then to bet on him.

After the architect has been selected or even while he is being selected, the librarian should also be concerned with writing a program for his building. The Committee regards it as very desirable that such a program be written. Opinions differ as to whether it should be written by the architect and the

librarian in collaboration or by each separately. There are advantages in each procedure. The former will surely be cheaper and may result in less conflict later since it is easier to come to agreement about abstract principles than it is about drawings in which the architect, dispassionate as he may try to be, cannot escape some pride of authorship. The advantage of separate program writing is that the architect is by training persuasive and as a collaborator is likely to talk the librarian out of ideas which are important and which should be preserved for discussion at a more concrete stage. If the librarian and his colleagues do write a program, however, they should be certain that they do not impose this program as law upon the architect. The latter should be encouraged to do his own travel, make his own researches, come up with his own program. When the two programs are laid upon the table for discussion, the areas of disagreement will quickly be found and when these areas are specific it is far easier to arrive at final and good conclusions.

In writing the program, the librarian should surely not pay attention to the budgetary limitations previously discussed. He should think of his institution and its program in the broadest terms and express himself fully and freely. He can, if he desires, assess priorities, since he can be almost certain that his program will be beyond his capacity to achieve. But restrictions of cost at this point are quite undesirable. Finally, it is probably true that almost every librarian writing a program will be well advised to employ a consultant from some other institution to study his situation and needs and make a report. The cost of such a report is negligible when measured against the cost of the building—never more than a very few thousand dollars and more often one to two. It is almost certain that such an outside view will bring to light things which the librarian himself has not considered.

Members of the Committee have also found panel discussion of the program with others who are planning buildings to be of the greatest assistance, although the benefit of these discussions is more sharply felt at the stage when preliminary expressions of the program in drawings can be presented for explicit criticism. It will hardly be necessary to remind university

people that the faculty should be closely consulted during the preparation of the program.

Numerous examples of programs are now to be found,[1] and the resourceful librarian will have no difficulty in locating examples which are pertinent to his problem; it can be stated categorically, however, that none will ever be found which can be adopted verbatim. The librarian cannot escape personal responsibility in the matter of program.

When the architect has been selected and the programs are ready, the interesting period, that of conflict, begins. The conflict cannot be escaped if two strong men are brought together, and both should be strong men. The problem is not that of avoiding conflict but of making it useful and of making sure that no conflict is crystallized into personal oppositions.

Almost every librarian, like almost every other man, is likely to want to make sketches of space arrangements in the form of crude plans. This desire should be resisted in most cases. The layman's sketches are seldom useful to the architect. Even a mediocre architect is better trained in the organization of space than a brilliant librarian. What the librarian can and should do is to indicate, preferably by diagrams, the required relations of one type of space to another, the necessary size of the spaces, the proportions of the space where that is significant from an operating point of view, and any other special requirements of the space, such as that of north light or of no light at all. Even more than the space relation diagrams, the librarian should be prepared to present to the architect carefully worked out diagrams of the expected flow of people in the library and of every process which is important, such as the step-by-step analysis of the passage of a book from the receiving room to the shelves. All too often architects find that librarians are unable to present careful analyses of how they want to organize the working

[1] *Program for a New Library Building at the Mass. Institute of Technology*, Office of the Director of Libraries, M.I.T., Cambridge, April 2, 1945; *Report to the Trustees of Rice Institute on the Proposed New Library Building*, by John E. Burchard, January 1, 1946 (unpublished); *Report to the President of Wellesley College on Requirements for a Satisfactory Library*, June 12, 1945 (restricted, but published in shortened form in *Wellesley College Bulletin*, Annual Library Report Number, Wellesley, Massachusetts, September 1945).

rooms. It would not be possible to design a factory without corresponding flow sheets with respect to manufacturing processes, and the architect cannot be expected to conjecture these things for the librarian. In preparing such flow diagrams, the librarian should be careful to include only the necessary processes. At this point he will be well advised to turn the matter over to the architect temporarily and await the architect's first interpretation of the librarian's needs.

When this interpretation is ready, the librarian should not expect the architect to bring in a wide variety of alternatives from which he is to select. Good architecture is not marketed like shoes. Often the best architects will bring in only one scheme and find out what is wrong with it rather than offer several choices. The librarian should not be disappointed but rather encouraged if this is what happens. It is the better way.

It would be a miracle if this first scheme were really satisfactory. The architect may have deliberately changed relations which the librarian considers essential. Here is where the conflict begins. It is important that it be carried on usefully. On the one hand the librarian is likely to find the architect arrogant, assuming an omniscience which the librarian knows he cannot possess. The architect is likely to have seen some arrangement which impresses him as excellent (and which was excellent in its place) and to have transported it into his scheme in opposition to what the librarian has requested. This is no occasion for heat. It is unlikely that any architect can in his brief research accumulate as much experience about the working parts of a library or as to what things are most important for the institution as the librarian should have acquired with his much more extended experience. On the other hand, the librarian's experience may well have conventionalized him and the architect's intuition may be more reliable than the librarian's experienced conviction. In these circumstances it is incumbent upon the librarian to look with great interest on the proposals of the architect, to study them with more than usual care as challenges to his own thinking, and not to reject them out of hand. This he should do especially with respect to radical suggestions, for here there is more chance for intuition to be a force than in relatively trivial modifications of established

methods. The librarian should not call the architect emotional nor should the architect call the librarian stodgy.

If, however, after an honest effort to accept these suggestions the librarian remains of his original conviction, he should be adamant with respect to the working parts of the library. He will have to administer the building after the keys have been turned over and if mistakes are to be made they had better be his and not the architect's.

The matter is quite the converse when it comes to specifications of structure, of equipment, of materials, of furniture, and of decoration. Here the architect's experience is the greater. The librarian should know what he wishes to accomplish; he should not hesitate to call the architect's attention to experience in other libraries with the durability of materials, with the efficiency of various types of library furniture, with whatever he can learn about illumination. But after he has presented these with vigor, he should be content to rely upon the decision of the professional man in areas where professional experience is obviously more telling than limited personal experience. Here the architect has a reason to be adamant and the librarian should accept this attitude. This applies especially to matters of taste such as that of color schemes. The architect's taste can be expected to be more fully developed and more impersonal than that of the librarian.

The conflicts will of course almost never be so sharply etched as this text has suggested. There are middle grounds, moreover, for which no prescription can be written.

There has certainly been a tendency in the library world to complain of and to make fun of the architect and to blame him for the mistakes, often egregious, which have been made in library planning. Whatever may have been the case in the past, the Committee has no reason to believe that librarians in today's universities are being deprived of their full say, though there have in the past been too many conspicuous examples, involving important structures in institutions of higher learning in which the librarian has been completely ignored in the selection of the architect and in the determination of the site and plan, and in which the librarian's program has been disregarded. When librarians are given their full share in planning,

the responsibility for failure, when it occurs, can no longer be dodged. It seems well, however, to emphasize, in closing, the principles upon which a good collaboration can be established, lest there be some institution where these principles are not yet followed:

1. The librarian should be the first to be consulted if a new library project is envisaged.

2. The librarian should have a strong voice in the highest councils of the administration and the trustees on the question of the general architecture of the library.

3. The librarian should have an equally strong voice at the same levels in the selection of the architect.

4. The librarian should be supplied with sufficient funds to prepare a thoroughgoing written program and to employ outside consultants to assist him in the preparation of such a program.

5. The architect should be permitted and encouraged to make an independent survey and program.

6. The librarian should be present at *all* conferences involving the location, design, cost, or any other attribute of the building.

7. If the librarian and the architect reach an impasse on any question, and as a matter only of last resort, the librarian should be the arbiter of all matters relating to organization of space in the building for working purposes, and the architect the arbiter of specifications of materials, construction, equipment, and *décor*.

8. Since most institutions have a building committee, the librarian should be made a temporary member of that committee for all matters concerned with the library.

9. The architect and the librarian should approach each other with respect, should welcome conflict if it springs from honest conviction, and should collaborate and not compete. Neither should seek to dominate the other, or to appeal from the other to courts of higher resort. Both have places to which they can appeal; neither should do so.

If the librarian is able and the architect is wisely selected,

the collaboration can prove an exciting and memorable experience for both; the building can be one which is at once a pleasure to administer for the librarian, a credit and a monument to its designer, the architect, and, most important of all, a perennial joy to the user.

CHAPTER IX

LIBRARY PLANNING: A BIBLIOGRAPHICAL ESSAY

Early Planning. Present-day interest in the planning of library buildings, as evidenced by the activities of the Cooperative Committee and its publications and by the "buildings institutes" that have been held in Chicago in 1946 and in San Francisco in 1947, is not a new phenomenon in the library world. American librarians have long been interested in the planning, not only of their own buildings, but in the general philosophy of planning currently in vogue. In the late nineteenth century they were forthrightly critical of the buildings then being planned and constructed—more critical, indeed, than they were to be again until the formation of the Cooperative Committee late in 1944. Surprisingly enough, librarians were critical of many of the same things which the Cooperative Committee has pilloried some fifty years later. Monumental reading rooms with lofty ceilings, for example, were condemned as wasteful of space and heat[1] long before many of the buildings containing such rooms were erected.

Interest in the proper planning of library buildings was so general that the American Library Association, in conference at Cincinnati in 1882, unanimously resolved, "that, in the opinion of the Association, the time has come for a radical modification of the prevailing typical style of library building, and the adoption of a style of construction better suited to economy and practical utility." Poole, who quotes this resolution,[2] adds laconically that it could not be regarded as an endorsement of any of the specific plans which had been under discussion; yet the two buildings which had been most under censure, the Boston Public Library and the Library of Congress, were both erected according to plan.

[1] William F. Poole, "The Construction of Library Buildings," *Library Journal*, VI (1881), 69-77.

[2] William F. Poole, "Progress of Library Architecture," *Library Journal*, VII (1882), 180-86.

Five years later Larned expressed the view[3] that, except in the case of the Library of Congress, the objections of Poole had been met, but in the discussion which followed Larned's report, Poole himself was far less enthusiastic.

Soule's "Points of Agreement,"[4] quoted with approval in the opening chapter of the present monograph, was the last significant contribution to the subject of planning until the appearance of a volume by the same author in 1912.[5] Though many of the details of this work are now out of date, the discussions of the principles of planning still contain much to enrich the library planner's background and facilitate his approach to modern building problems.

Neither interest in planning nor actual construction ceased during the next two decades. In 1915 the Snead & Company Iron Works issued an important book which has been described as "the first real volume on library plans that was generally useful for university libraries";[6] and in 1932 appeared Gerould's *College Library Building*.[7] Though this was aimed primarily at the college library and though it is now seventeen years old, it is still of some service in planning a university library. It contains many useful specific dimensions for rooms, reader space, card catalogues, and the like. The figures need checking, but they provide a useful point of departure.

Most of the important literature published prior to Gerould has been abstracted and brought together in a volume by Miss Drury.[8] Covering all types of libraries and dealing with heating, lighting, stacks, and equipment, this compilation constitutes a good browsing collection from which to gain the flavor

[3] J. N. Larned, "Report on Library Architecture," *Library Journal*, XII (1887), 377-95, 442-45.

[4] Charles C. Soule, "Points of Agreement among Librarians as to Library Architecture," *Library Journal*, XVI, San Francisco Conference Number (1891), 17-19.

[5] Charles C. Soule, *How to Plan a Library Building for Library Work*, Boston, 1912.

[6] Snead & Company Iron Works, *Library Planning, Bookstacks, and Shelving, with Contributions from the Architects' and Librarians' Points of View*, Jersey City, N.J., 1915.

[7] James T. Gerould, *The College Library Building: Its Planning and Equipment*, New York, 1932.

[8] Gertrude M. G. Drury, *The Library and Its Home* (Classics of American Librarianship, vol. 9), New York, 1933.

of long-time problems as a background for contemporary planning.

The most complete collection of descriptions, photographs, and floor plans of national, state, and university libraries all over the world was published in France in 1938[9] and is generally available in American libraries. It gives an opportunity to study many variant solutions of university library planning problems. A similar opportunity is afforded the planner of smaller libraries by Miss Hanley's *College and University Library Buildings*,[10] which gives a collection of floor plans and photographs accompanied by brief descriptions and criticisms.

Recent Planning. Recent interest in the planning of university library buildings may be said to coincide with the birth of *College and Research Libraries*, the first number of which contained an article[11] which called for provision in each new library building of space for expansion amounting to 50 per cent beyond an adequate provision for all existing functions and also urged maximum adaptability at minimum cost. Randall and Goodrich,[12] writing two years later, provided a good general discussion of the problems of planning, along with a good bibliography of plans which were suggested for study. Lyle's work in the same field[13] gave greater attention to details and included an extensive bibliography of descriptions of particular library buildings. More recently chapters by Wilson and Tauber[14] have provided a good analysis of the planning problem in the university library field as well as succinct summaries of administrative problems, such as departmentation and library cooperation, which have a bearing on the planning of buildings.

Schunk's *Pointers for Public Library Building Planners*[15]

[9] "Les Bibliothèques," *L'Architecture d'Aujourd'hui*, IX (1938), 2-102.

[10] Edna Ruth Hanley, *College and University Library Buildings*, Chicago, 1939.

[11] Frank K. Walter, "Essentials of a University Library Building—I," *College and Research Libraries*, I (1939), 40-46.

[12] W. M. Randall and F. L. D. Goodrich, *Principles of College Library Administration*, 2nd ed., Chicago, 1941.

[13] G. R. Lyle, *The Administration of the College Library*, New York, 1944.

[14] L. R. Wilson and M. F. Tauber, *The University Library; its organization, administration and functions*, Chicago, 1945.

[15] R. J. Schunk, *Pointers for Public Library Building Planners*, Chicago, 1945.

contains a valuable checklist of items which must receive consideration. It needs, however, to be used with caution since it is written from the viewpoint of public libraries and since it contains generalizations which are not valid for every specific case. In somewhat the same vein, but much more detailed, is a recent primer of library planning[16] which may well be examined point by point as working drawings are developed. The comprehensive papers of the "buildings institute" which was held at the University of Chicago in the summer of 1946 have recently been published under the editorship of Fussler.[17] There is also a valuable foreign commentary on recent American library building planning by J. F. Vanderheyden of the Albert I Memorial Library Foundation who visited this country in 1946 and was present at the Second Princeton Conference of the Cooperative Committee.[18]

The Library Program. The literature which might be garnered under this heading is voluminous and is left to more general bibliographies. So important, however, is Harvie Branscomb's *Teaching with Books*[19] that it must be mentioned here as an example of the kind of careful analytical thinking which every librarian must engage in before a program for a new library building can be developed. The place of the library in the instructional program of a particular university has been arrestingly set forth in *A Laboratory-Workshop Library for Princeton,*[20] a prospectus intended to elicit the interest of possible donors, and in *The Library as a Teaching Instrument,*[21] a similar brochure for the proposed library of the State Univer-

[16] D. K. Campbell and C. F. Goodwin, "A Primer of Library Planning," *Wilson Library Bulletin,* XX (1946), 843-59.

[17] Herman Fussler, ed., *Library Buildings for Library Service*; papers presented before the Library Institute at the University of Chicago, August 5-10, 1946.

[18] J. F. Vanderheyden, "De Nieuwe Bibliotheekbouw in de Verenigde Staten," Antwerp, 1947 (*Bibliotheekkunde Vlugschriften,* XX). Dr. Vanderheyden's findings have been more fully recorded in his unpublished "American Libraries, Buildings and Equipment; Report on Visit to U.S.A. Libraries, May-June, 1946" which the Editorial Subcommittee of the Cooperative Committee has been permitted by the Belgian American Educational Foundation Inc. to see in typescript.

[19] B. H. Branscomb, *Teaching with Books,* Chicago, 1940.

[20] Princeton: Committee on the New Library, 1944.

[21] Iowa City: University Library Planning Committee, 1945.

sity of Iowa. A thoughtful and detailed analysis of the building problem at the University of Pennsylvania, not so specifically oriented toward the problem of support, has also been published.[22]

Different from these statements relating to the functions of the library in relation to the educational objectives of a particular university is the detailed and specific analysis of all the activities which must find space in a library building, intended to provide the architect with the basic information which he needs in order to begin his study of a building problem. Such a program for the library of the Massachusetts Institute of Technology[23] was used to assist in the selection of an architect as well. After his selection, the architect's fundamental studies were used as illustrations for a brochure setting forth the "philosophy" of the library and the architect's plans for embodying it in a workable building.[24] A similar publication was issued in the interest of the new Fondren Library at Rice Institute.[25]

The Problem of Growth. The publication in 1944 of a remarkable work by Fremont Rider[26] sharply called the attention of American librarians to a disconcerting fact which they had but tardily and reluctantly come to realize, namely, that their libraries could not go on growing forever at a steadily increasing tempo. Though his book was written as an argument for the reduction of books in libraries to the dimensions of their own catalogue cards through a resort to microprint, the indication that research libraries might go on doubling in size every sixteen years all but eclipsed Rider's main thesis. Though his

[22] Bibliographical Planning Committee of Philadelphia, *Philadelphia Libraries: a Survey of Facilities, Needs, and Opportunities*, Philadelphia, (1942), 59-62, 86-90.

[23] *Program for a New Library Building at the Massachusetts Institute of Technology* (Mimeographed), Office of the Director of Libraries, M.I.T., 1945. A similar program was prepared by J. E. Burchard for the trustees of Rice Institute in 1946 but is unpublished; comparison may also be made with the *Report to the President of Wellesley College on Requirements for a Satisfactory Library*, a restricted document which was published in shortened form in the *Wellesley College Bulletin*, Annual Library Report Number. Wellesley, Massachusetts, September 1945.

[24] *Fundamental Studies: the Library at M.I.T.*, New York: Voorhees, Walker, Foley, and Smith, 1946.

[25] *The Fondren Library*, Houston: Rice Institute, 1946.

[26] Fremont Rider, *The Scholar and the Future of the Research Library*, New York, 1944.

assembly and interpretation of statistics were sufficient to cause grave concern, his argument was successfully challenged by Metcalf,[27] at least to the extent that the specter of indefinite geometrical growth was fairly well laid. Nevertheless, the problem of growth still constitutes one of the most serious challenges to American librarianship.

At least one librarian has endeavored to face the issue directly by declaring that a research library, properly selected, need not contain more than 1,500,000 volumes,[28] but most other proposed solutions involve doing something with the books rather than accepting so drastic a curtailment of ultimate size. One such solution is the storage library, which has been proposed for at least three regions in the country, has been placed in actual operation in one, and has been resorted to on a smaller scale by a number of individual libraries. A proposal for a co-operative storage library in the Chicago area[29] is still in the discussion stage, but the New England Deposit Library is in successful operation under the guidance of the Director of the Harvard University Library.[30]

Another solution of the problem of growth is being sought in cooperation among libraries. There are numerous examples of cooperation already in operation and an important literature is accumulating about them. The many difficulties involved have recently been reviewed by Wilson and Tauber,[31] by Downs,[32] and by Smith,[33] all with comprehensive references to previous writings. The most recent and ambitious venture in this field is the Farmington Plan, which, after prolonged discussion, the

[27] K. D. Metcalf, "Spatial Growth in University Libraries," *Harvard Library Bulletin*, I (1947), 133-54.

[28] Stanley Pargellis, "Building a Research Library," *College and Research Libraries*, V (1944), 110-14.

[29] John Fall, "A Proposal for a Cooperative Storage Library," *College and Research Libraries*, III (1941), 3-8.

[30] K. D. Metcalf, "The New England Deposit Library," *Library Quarterly*, XII (1942), 622-28; A. D. Osborn, "The New England Deposit Library," *College and Research Libraries*, V (1948), 21-28.

[31] See above, note 14.

[32] R. B. Downs, "American Library Cooperation in Review," *College and Research Libraries*, VI (1945), 407-15.

[33] Sidney B. Smith, "College and University Library Cooperation," *Library Quarterly*, XVI (1946), 122-89.

Association of Research Libraries began endeavoring to put into effect on an experimental and limited scale in 1948.[34]

Illumination and Air-Conditioning. Librarians have historically been more concerned with good lighting than with good ventilation, yet their concern has not always, nor indeed usually, resulted in the achievement of good lighting for library buildings. In view of the fact that the literature published before 1940 is now largely outdated by the increasing prevalence of fluorescent installations, attention may first be called to the work of Kraehenbuehl, who in 1941 published a general exposition of lighting principles,[35] together with a technical bibliography, and a detailed discussion of table lighting for libraries.[36] He also presented a paper on library lighting at the University of Chicago Institute in 1946.[37]

The June 1946 issue of the General Electric Company's *Magazine of Light*, in two articles, contains a lengthy discussion of school lighting,[38] much of which is applicable to library installations. The articles include detailed studies of the cost of incandescent and fluorescent installations and of the nature of various kinds of light and their place in the spectrum. Caution should be observed, however, with respect to the recommendations as to the desirable amount of illumination, for there is good opinion that forty foot-candles are more than is often necessary or desirable. Problems of good seeing and an analysis of the controversy over fluorescent lighting as presented to the Cooperative Committee at the Second Princeton Conference are discussed in Chapter VI of the present monograph, where full references are given. A detailed and comparatively impar-

[34] K. D. Metcalf and E. E. Williams, "Proposal for a Division of Responsibility among American Libraries in the Acquisition and Recording of Library Materials," *College and Research Libraries*, v (1944), 105-9; K. D. Metcalf, "The Farmington Plan," *Harvard Library Bulletin*, II, no. 3 (1948), 296-308.

[35] J. O. Kraehenbuehl, "Lighting the Library," *College and Research Libraries*, II (1941), 231-36.

[36] J. O. Kraehenbuehl, "Library Table Lighting," *College and Research Libraries*, II (1941), 306-17.

[37] Herman Fussler, ed., *Library Buildings for Library Service*, Chicago, 1947, pp. 141-67.

[38] R. C. Putnam and J. R. Anderson, "Latest Techniques of School Lighting," *Magazine of Light*, XV (1946), 45-55, 76-78.

tial discussion of the problems of library lighting was presented by General Electric's J. M. Ketch at the San Francisco conference of the American Library Association in 1947.[39] An important approach to the problem of good lighting through a study of readers' reactions under varying conditions has been made by Holway and Jameson in preparation for the relighting of the Harvard School of Business Administration.[40]

Although air-conditioning is now considered desirable in most climates for the preservation of library materials as well as for the comfort of readers, it is frequently dropped from consideration because of the real or apparent cost. It has been represented that the cost can be materially reduced by the use of a new triethylene glycol method[41] not yet generally available. A full analysis of this method, as well as of other systems of air-conditioning, together with cost studies, was presented to the Library Buildings Institute at the University of Chicago in 1946 by Robert H. Gates.[42] Though the Gates paper as presented made a strong impression, the triethylene glycol method has by no means as yet won general acceptance. A more casual article in a recent number of the *Architectural Record*[43] contains some of the same technical details which are discussed by Gates as well as the specifications for the proposed installation of air-conditioning in the new library at the Massachusetts Institute of Technology.

A more orthodox bibliography, though not directed specifically at library buildings, would be as follows: J. R. Allen and others, *Heating and Air Conditioning*;[44] B. F. Raber and F. W. Hutchinson, *Refrigeration and Air Conditioning Engineering*;[45]

[39] J. M. Ketch, "Library Lighting," *Bulletin of American Institute of Architects*, I (1947), 34-42.

[40] Alfred H. Holway and Dorothea Jameson, *Good Lighting for People at Work in Reading Rooms and Offices*, Boston: Harvard University, Graduate School of Business Administration, Division of Research, 1947.

[41] "Dehumidifying and Air Sterilization with Triethylene Glycol," *Heating and Ventilation*, XLIII (Jan., 1946), 78-80.

[42] R. H. Gates, "Modern Air Treatment," in H. H. Fussler, ed., *Library Buildings for Library Service*, Chicago, 1947, pp. 114-40.

[43] H. L. Alt, "Air Conditioning for Books and People," *Architectural Record*, C (Nov., 1946), 117.

[44] New York, 1946, 6th edition.

[45] New York, 1945.

C. O. Mackey, *Air Conditioning Principles*;[46] American Society of Heating and Ventilating Engineers, *Heating, Ventilating, and Air Conditioning Guide*;[47] and American Society of Refrigerating Engineers, *Refrigerating Data Book*.[48]

Technological Problems. Problems of stack location and construction have puzzled librarians from the beginning of library planning as we know it today. The system of alcoves, condemned by Poole[49] and typified by the Peabody Library, gave way to the multi-tiered stack which, considered by itself, still remains the most efficient method of book shelving. Poole's proposal to shelve books in rooms fifteen feet high near the places where they were to be used was ignored until more recent times when the multi-tiered stack appears to be outliving its usefulness. Bernard Green, who installed the stack in the Library of Congress, was of the opinion that stacks need not be provided with daylight and that they might well be relegated to the least desirable portions of a building.[50]

It was not until 1933 that Angus Snead Macdonald published the first modern visionary conception of a modular flexible library building.[51] The idea was expanded the following year in an article describing flexible construction in greater detail and emphasizing the evident fact that electricity made lofty ceilings unnecessary.[52] Ten years later a great industrial research laboratory, in the planning and construction of which the modular, flexible conception was fully accepted, was described in *Convenience for Research*,[53] a monograph which made the applicability of flexible construction to libraries obvious. In the spring of 1944 the State University of Iowa began to develop plans

[46] Scranton, Pa., 1941 (International Texts in Mechanical Engineering).
[47] New York, 1947.
[48] New York, 1943.
[49] See above, note 1.
[50] B. R. Green, "Library Buildings and Book Stacks," *Library Journal*, XXXI (Conference number, 1906), 52-56.
[51] A. S. Macdonald, "A Library of the Future," *Library Journal*, LVIII (1933), 971-75, 1023-25.
[52] A. S. Macdonald, "Some Engineering Developments Affecting Large Libraries," *Bulletin of the American Library Association*, XXVIII (1934), 628-32.
[53] D. T. Graf, *Convenience for Research*, New York: Voorhees, Walker, Foley & Smith, 1944.

for a modular library which were made public by Ellsworth two years later.[54] In 1945 Macdonald published a more detailed exposition of the library possibilities of flexible modular construction.[55] Variations of the concept have also been drawn into the plans of the new library at Princeton University,[56] and of the proposed libraries at the Massachusetts Institute of Technology,[57] Rice Institute,[58] and the University of Georgia.[59]

Since the initial description of the nature of library noise[60] was published in 1938, no progress has been made in determining the optimum conditions of sound and silence for libraries. The technology of acoustics, however, has continued to be developed, and it is now possible to adapt general principles, such as those described by Rettinger,[61] to acoustical conditions desired in libraries as soon as they can be defined in general or for particular libraries. A recent article in the *Architectural Record*,[62] in addition to some general discussion, deals briefly with the acoustical problem at Iowa and gives some specifications for the library of the Massachusetts Institute of Technology.

Beyond the space-consuming aspect of the problem of library growth, there is the equally difficult task of gaining effective control over the ever-increasing volume and complexity of the knowledge which is stored in our libraries. The solution of this problem is perhaps not even in sight, but an arresting possibility, through the use of microfilm, has been envisioned by

[54] R. E. Ellsworth, "A Modular Library for the State University of Iowa," *American School and University; a Yearbook*, New York, 1946, 98-105.

[55] A. S. Macdonald, "New Possibilities in Library Planning," *Library Journal*, LXX (1945), 1169-74.

[56] See above, note 20.

[57] See above, note 24.

[58] See above, note 25.

[59] Cooperative Committee on Library Building Plans, *The North Carolina Conference . . .*, March 18-19, 1947, Philadelphia: Stephenson-Brothers, 1947.

[60] E. W. McDiarmid and G. R. Tatum, "Library Noise," *Library Quarterly*, VIII (1938), 200-9.

[61] Michael Rettinger, *Applied Architectural Acoustics*, Brooklyn: Chemical Publishing Company, 1947.

[62] E. J. Content, "Sound Control in Libraries," *Architectural Record*, C (Nov., 1946), 121.

Vannevar Bush[63] and pushed even farther by John Burchard.[64]

Basic to the study of the use of microfilm and other forms of reproduction of research materials is the *Manual* of Binkley published in 1936.[65] Supplementing, but not replacing it, is Fussler's volume on photographic reproduction for libraries published in 1942.[66] The chain of development in this area during the last decade has been well summarized by Tate,[67] who shows that while progress has been very significant, much still remains to be done. This is true not only in the field of photography but also in the application of punched-card procedures to libraries, the experience and possibilities of which have been summarized with complete bibliography by Maxfield.[68]

The Librarian and the Architect. "The architect is the natural enemy of the librarian," declared C. A. Cutter before the Catskills Conference of the American Library Association in 1888,[69] and he went on to assert that architects paid no attention to the uses to which a library building was to be put. He was particularly bitter about the work of H. H. Richardson, as illustrated in the Howard Memorial Library. He was promptly answered, however, by W. I. Fletcher, who drew attention to the disagreements among librarians and pointed out that the architect usually worked for a committee, or a donor, but seldom for or with the librarian, who in many cases was not appointed until after the building was completed.[70]

The architect, John L. Mauran, writing one of the early pleas

[63] Vannevar Bush, "As We May Think," *Atlantic Monthly*, CLXXVI (July, 1945), 101-8.

[64] J. E. Burchard, "The Wreck of Matter and the Crush of Worlds," *Technology Review*, XLIX (Nov., 1946), 28, 64-65.

[65] R. C. Binkley, *Manual on Methods of Reproducing Research Materials*, Ann Arbor: Edwards Brothers, 1936.

[66] H. H. Fussler, *Photographic Reproduction for Libraries: a Study of Administrative Problems* (University Studies in Library Science), Chicago, 1942.

[67] V. D. Tate, "From Binkley to Bush," *American Archivist*, X (1947), 249-57.

[68] D. K. Maxfield, "Library Punched Card Procedures: Past Experience and Future Possibilities," *Library Journal*, LXXI (1946), 902-5, 911.

[69] "Librarians and Library Architecture," *Library Journal*, XIII (1888), 389-40.

[70] W. I. Fletcher, "Architects and Librarians: an Irenicon," *Library Journal*, XIII (1888), 388-89. (From *American Architect*, 27, Oct., 1888.)

for a functional approach to library buildings, emphasized three precepts: select the librarian, select the architect, design the interior first.[71] And the architect Louis E. Jallade, writing more than thirty years later, gave as his first three principles: prepare a survey, select an architect, plan with the architect.[72] All these precepts, or principles, were discussed by a friendly and cooperative group of architects and librarians at the Second Princeton Conference in 1946,[73] when little or no evidence transpired that Cutter's bitter remark, however true it may have seemed in 1888, had any validity today.

The Cooperative Committee's Publications. Though most of the publications of the Cooperative Committee have already been cited above, they may well all here be summarized in order. The first one to be extensively distributed was *The Orange Conference*,[74] an edited condensation of the stenographic report of a three days' meeting in October, 1945. The meeting was held in a full-scale "mock-up" of a modular library which had been erected by Snead & Company at its factory in Orange, Virginia. In addition to descriptions of modular construction, there were discussions of lighting and ventilation, and criticisms of the plans of new libraries proposed for the State University of Iowa, Rice Institute, the Massachusetts Institute of Technology, and the University of Pennsylvania.

The Second Princeton Conference of the Cooperative Committee,[75] held in June 1946, met several times in a full-scale "mock-up" of a portion of the proposed new library for Princeton University.[76] The condensed stenographic report includes discussions of lighting, basic educational and administrative problems, and detailed criticisms of the library plans of the

[71] J. L. Mauran, "The Relation of the Architect to the Librarian," *Library Journal*, XXVI (Conference number, 1901), 43-46.

[72] L. E. Jallade, "Are You Prepared to Plan a New Building?" *Library Journal*, LXIX (1944), 1077-79.

[73] Cooperative Committee on Library Building Plans, *The Second Princeton Conference . . .*, June 12-14, 1946, Philadelphia: Stephenson-Brothers, 1947.

[74] Cooperative Committee on Library Building Plans, *The Orange Conference . . .*, Oct. 26-28, 1945, Philadelphia: Stephenson-Brothers, 1946.

[75] See above, note 73.

[76] R. B. O'Connor and W. H. Kilham, Jr., "Full size Mock-Up for Library Planning," *Architectural Record*, CI (Jan., 1947), 99-101.

following institutions: Rice Institute, Harvard University Undergraduate Library, and the Massachusetts Institute of Technology. It concludes with a discussion of the relation of the librarian and the architect in which members of both professions participated. A brief account, or digest, of this meeting has been published by Burchard.[77]

A very summary report of the North Carolina Conference,[78] which was held in March 1947, includes detailed criticisms of the new library plans of Ohio State University, Duke University, the University of Wisconsin, the University of Michigan, the University of North Carolina, Woman's College of the University of North Carolina, and the University of Georgia. The Chicago meeting of the Committee, held on January 27 and 28, 1948, was reported in a pamphlet issued by Louis Kaplan, Associate Librarian of the University of Wisconsin and the present secretary of the Cooperative Committee.

Work in Progress. In the summer of 1946 the University of Chicago Graduate Library School held a week-long "institute" on Library Buildings for Library Service. The entire proceedings have now been published.[79] A "buildings institute" was also held at the San Francisco Conference of the American Library Association in July 1947. All five sessions were fully recorded and publication in some form is to be expected. Indeed, one important paper, on lighting, has already appeared.[80]

The most recent summary of the literature of library planning is contained in an A.I.A. Guide.[81] The portion so far published is concerned almost wholly with the public library, though some of the technical material is applicable to the university library as well. It offers little or no opinion of its own, but quotes the opinion of others without evaluation, and

[77] J. E. Burchard, "Postwar Library Buildings," *College and Research Libraries*, VII (1946), 118-26.

[78] See above, note 58.

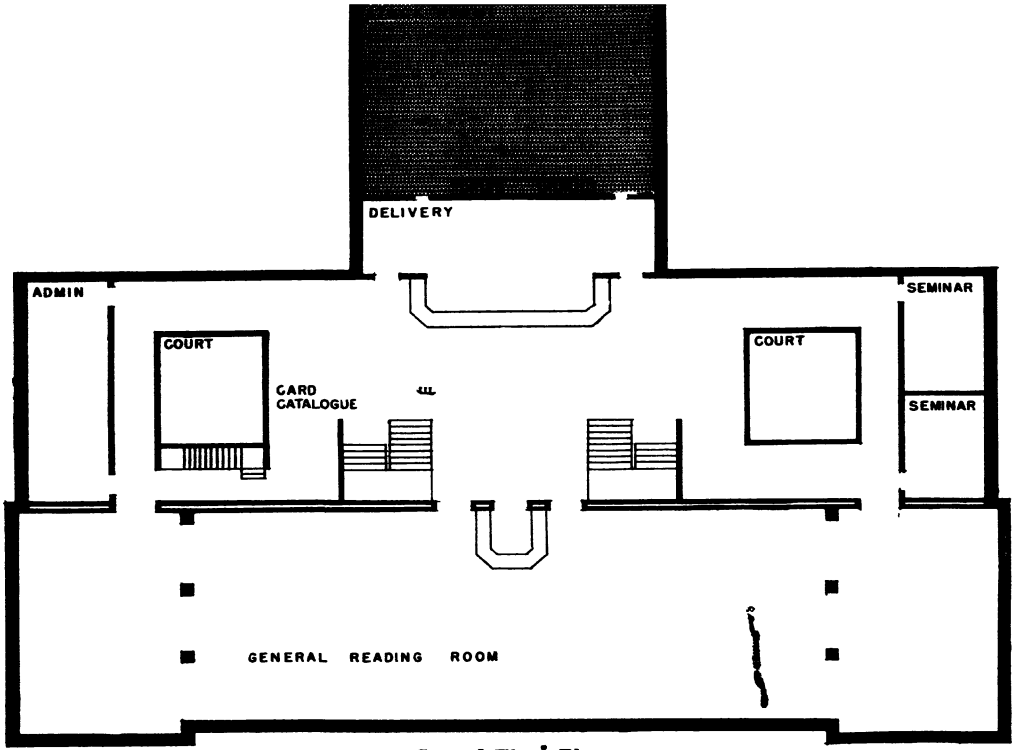
[79] H. H. Fussler, ed., *Library Buildings for Library Service*; papers presented before the Library Institute at the University of Chicago, August 5-10, 1946. Chicago, 1947.

[80] J. M. Ketch, "Library Lighting," *Bulletin of the American Institute of Architects*, I (Sept., 1947), 34-42.

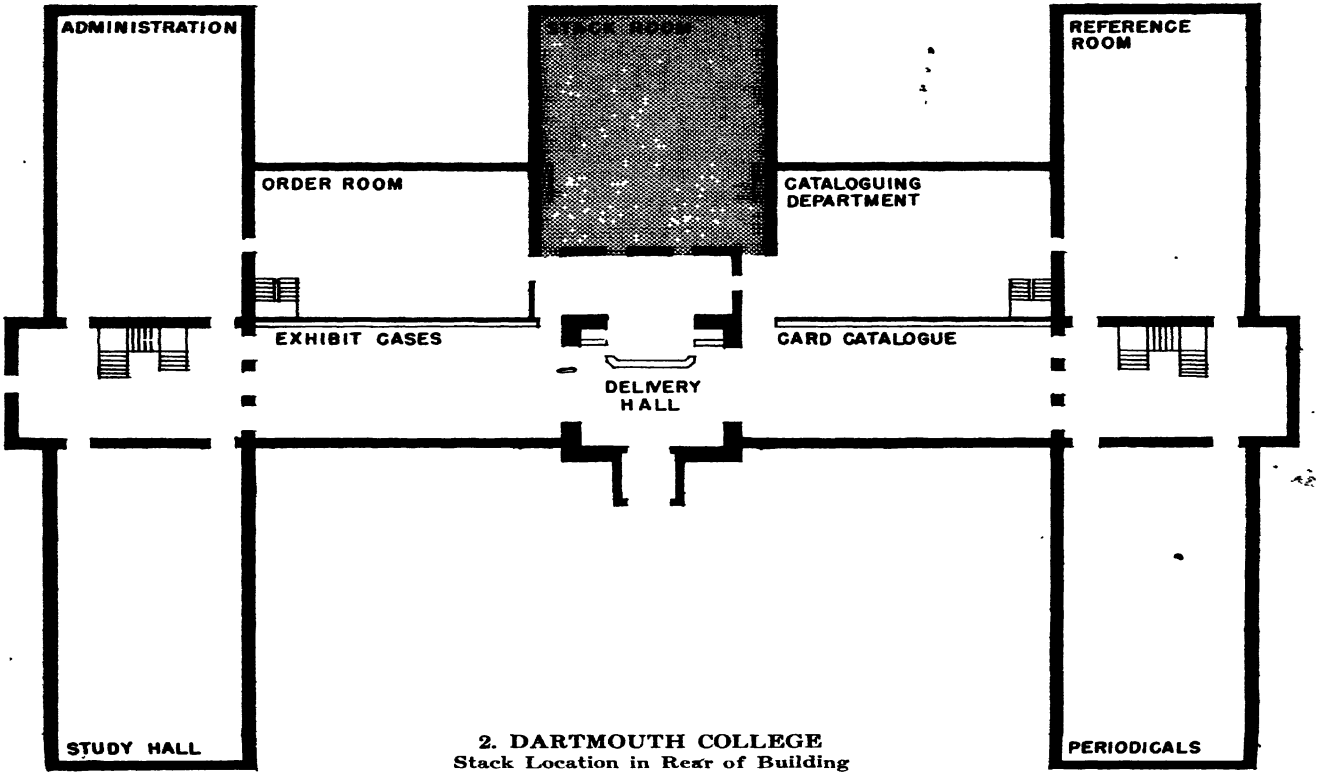
[81] "Building Type Reference Guide No. 3: the Library Building," *Bulletin of the American Institute of Architects*, I (July, 1947), 25-54.

sometimes without benefit of context. Most interested library planners, librarians and architects alike, will want to read in full the material which it abstracts. An annotated bibliography, including a long list of references to plans of specific libraries, is helpful. A brief supplement on college and university libraries has now been published but adds little of major importance.[82]

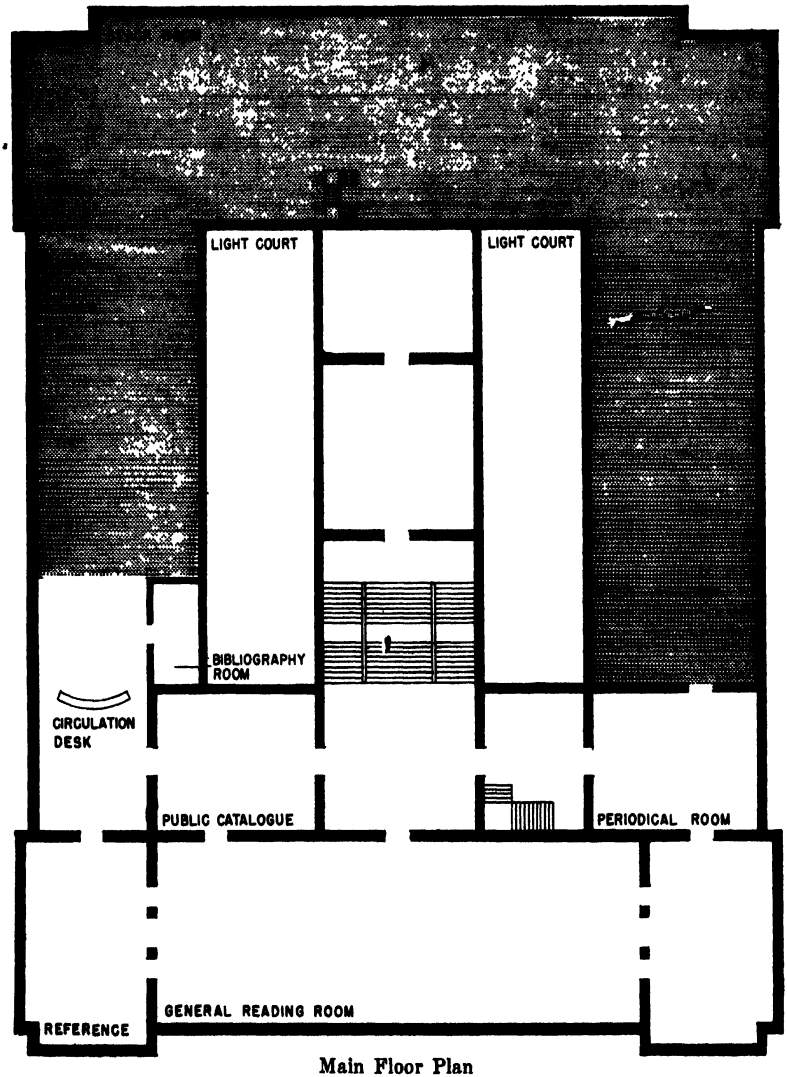
[82] "Supplementary Bibliography on Library Planning," *Bulletin of the American Institute of Architects*, I (Sept., 1947), 42-44.



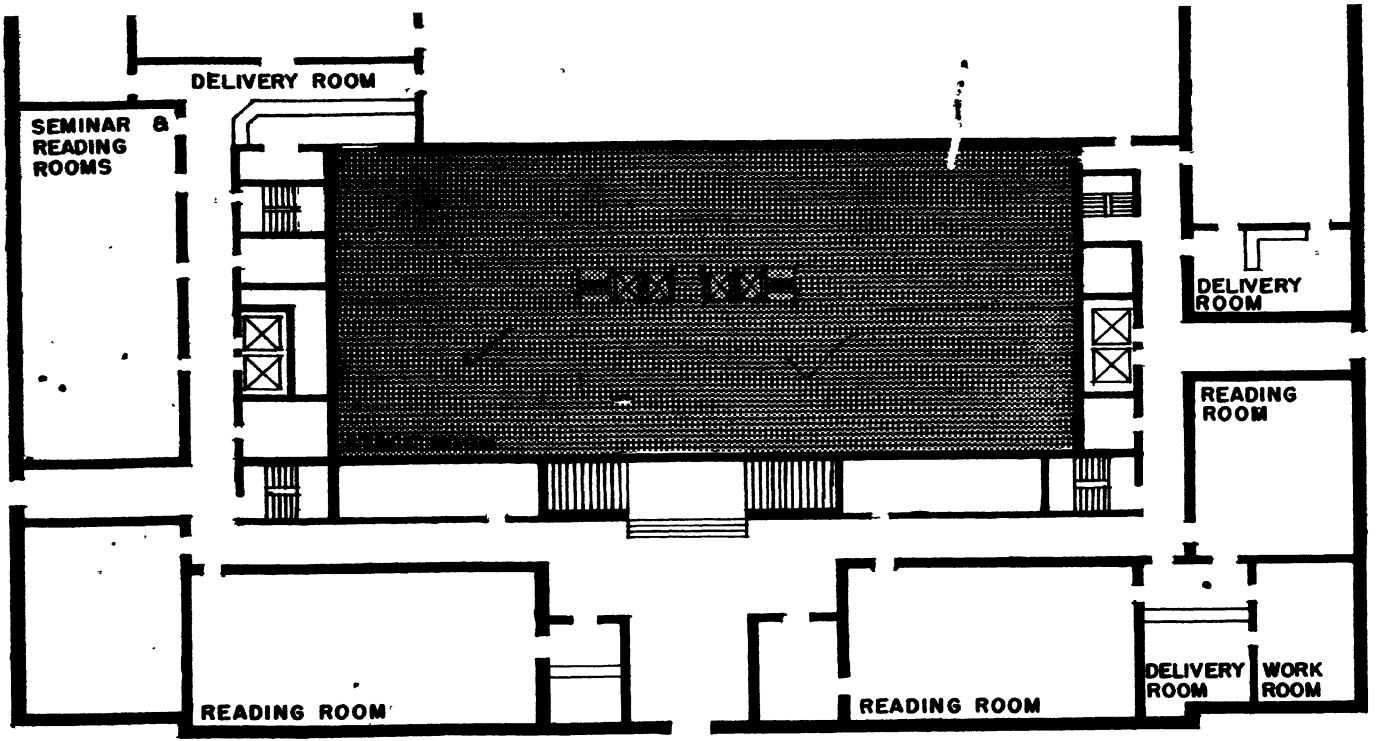
Second Floor Plan
1. THE UNIVERSITY OF KANSAS



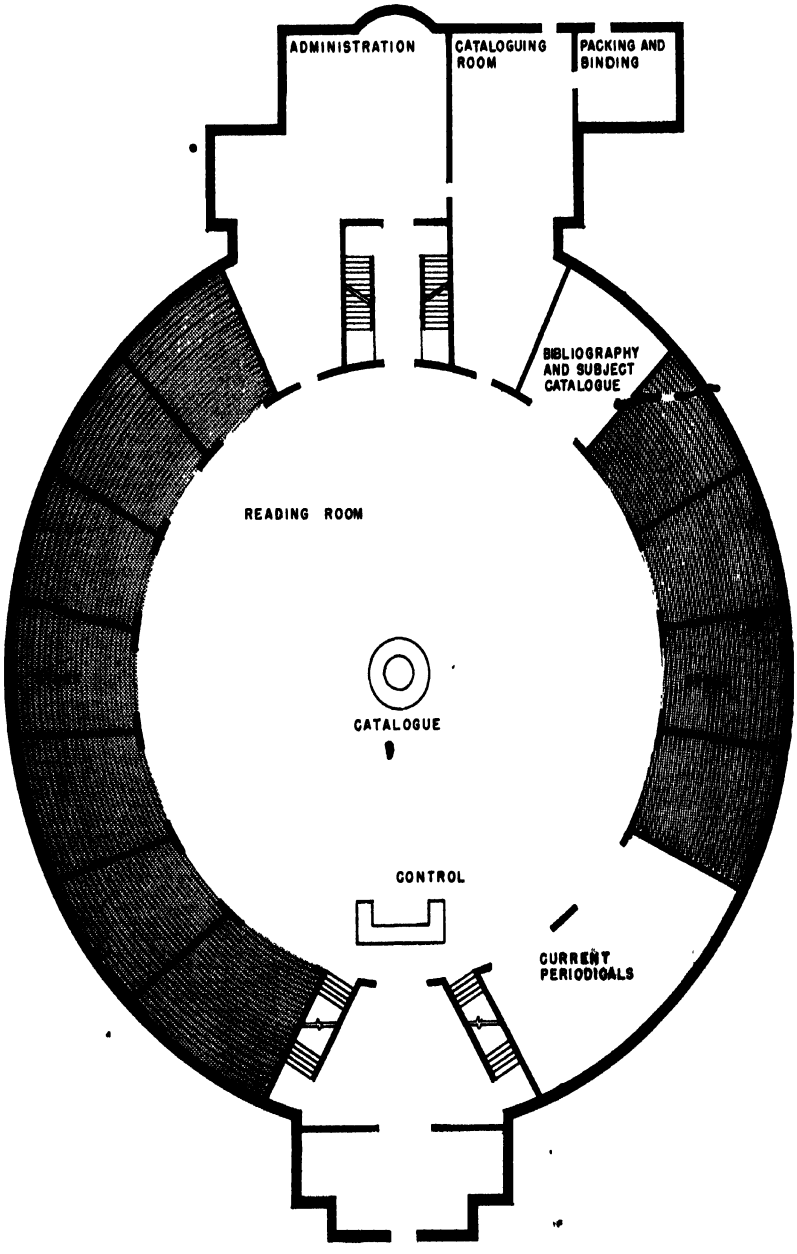
2. DARTMOUTH COLLEGE
Stack Location in Rear of Building



Main Floor Plan
8. HARVARD UNIVERSITY
Stack Location in Rear of Building



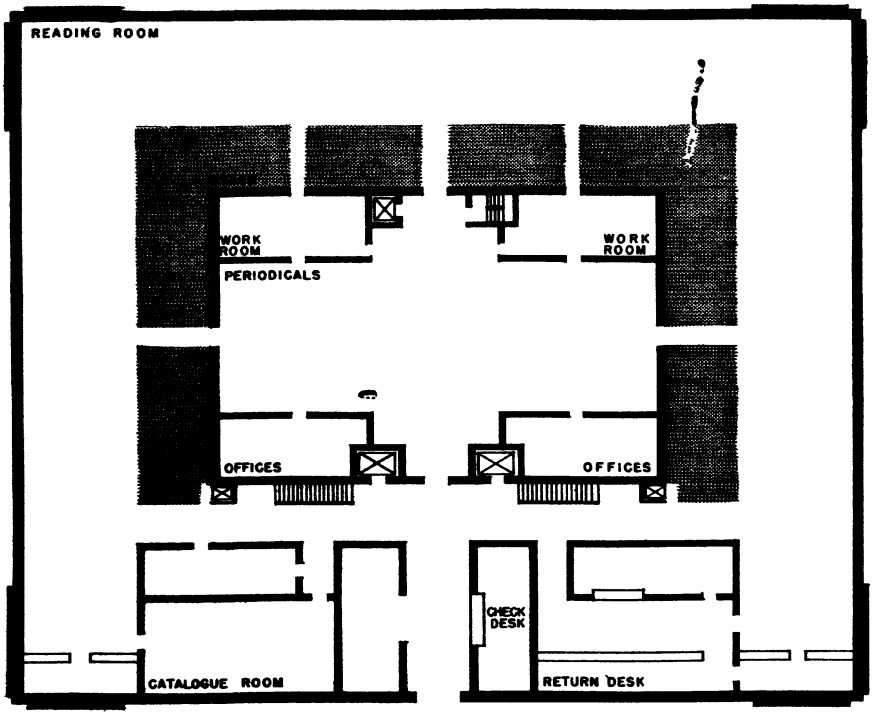
4. COLUMBIA UNIVERSITY
Stack Location in Center of Building



Ground Floor Plan

5. UNIVERSITY OF LEEDS

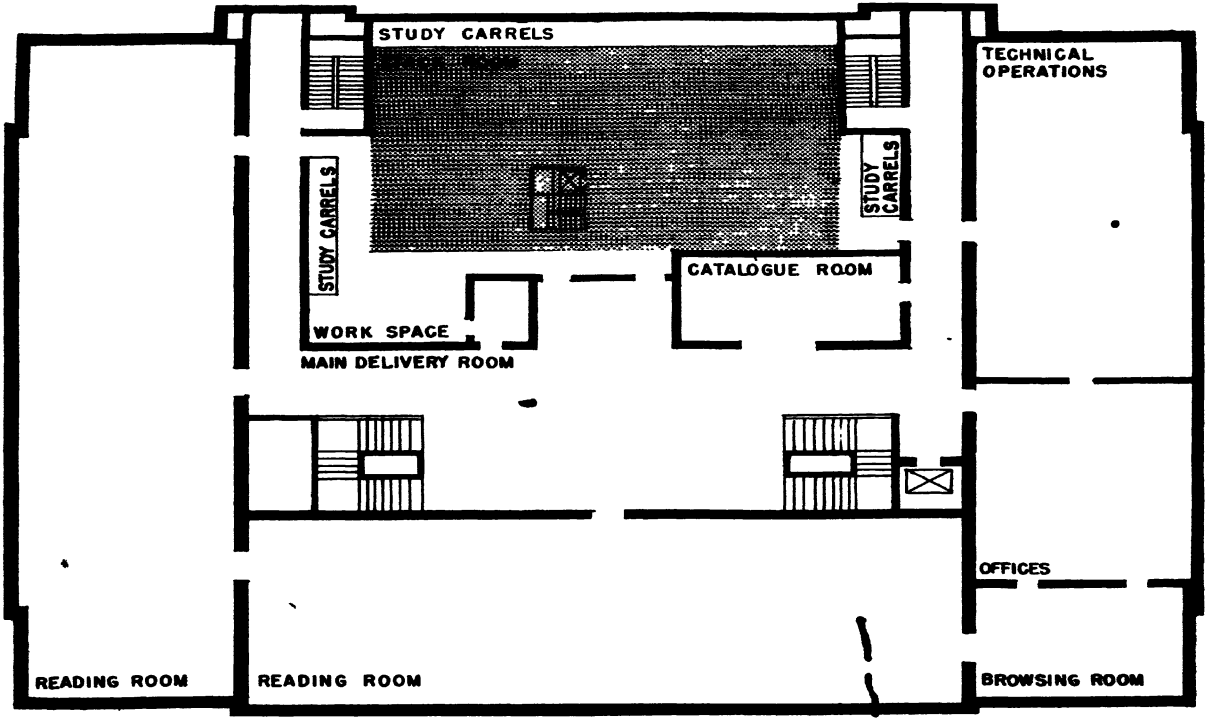
Stack Location around the Reading Room



First Floor Plan

6. CLEVELAND PUBLIC LIBRARY

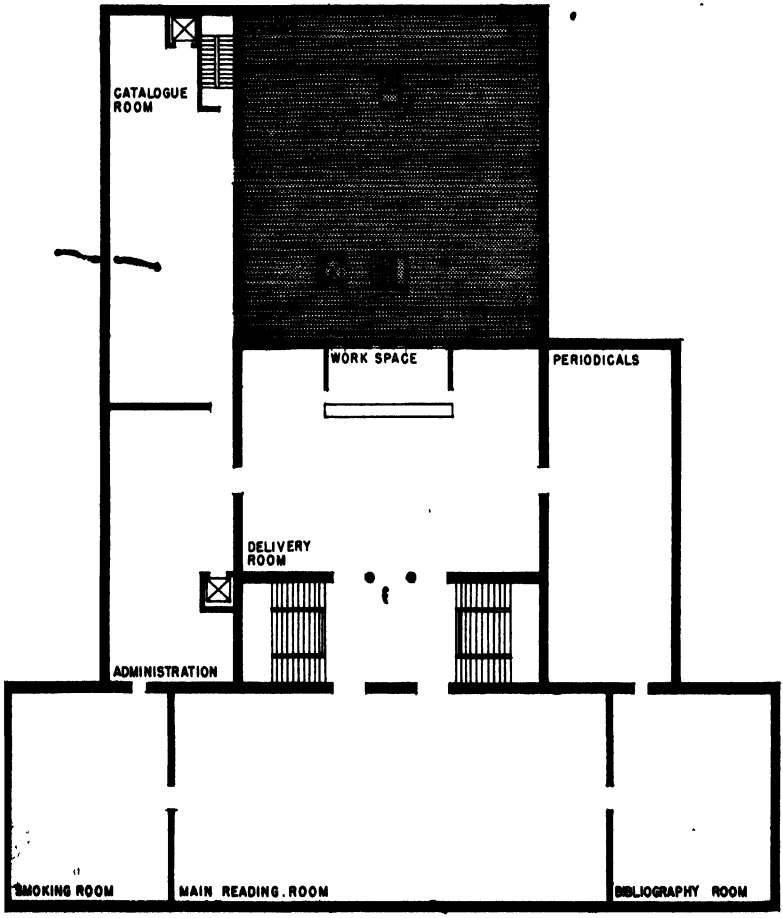
Stack Location in Reading Room



Second Floor Plan

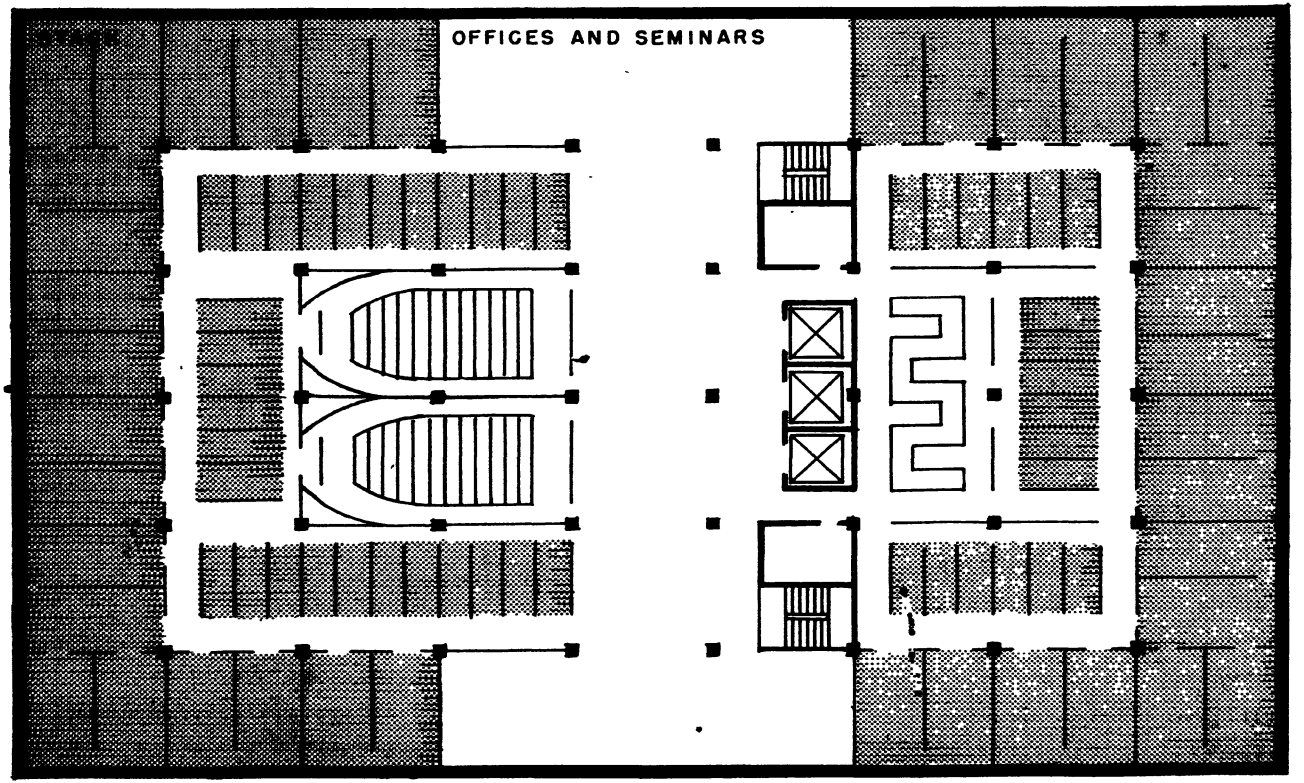
7. THE UNIVERSITY OF NEBRASKA

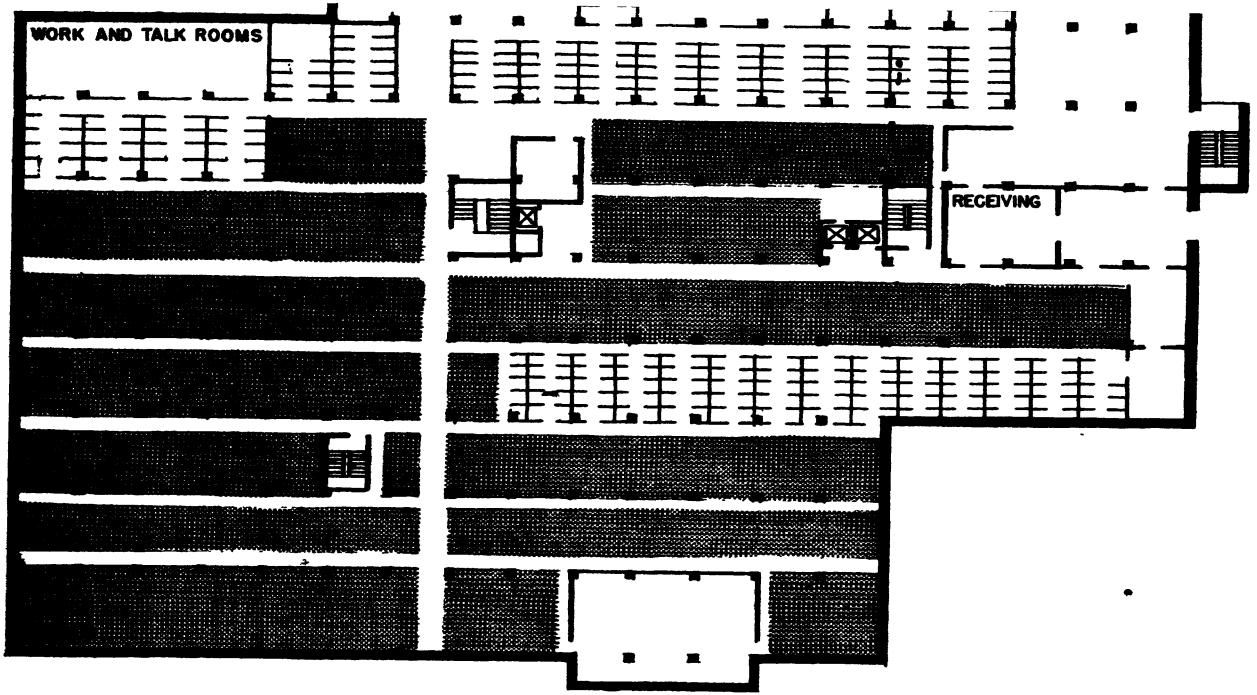
Stack Location in Reading Room



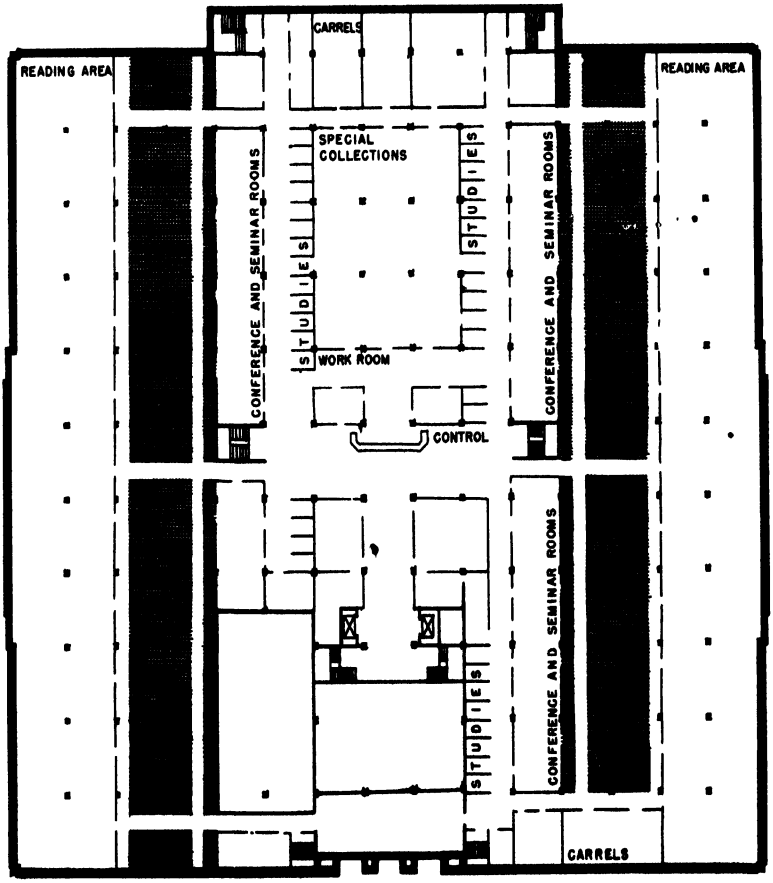
Second Floor Plan

8. THE UNIVERSITY OF ROCHESTER
Tower Stack

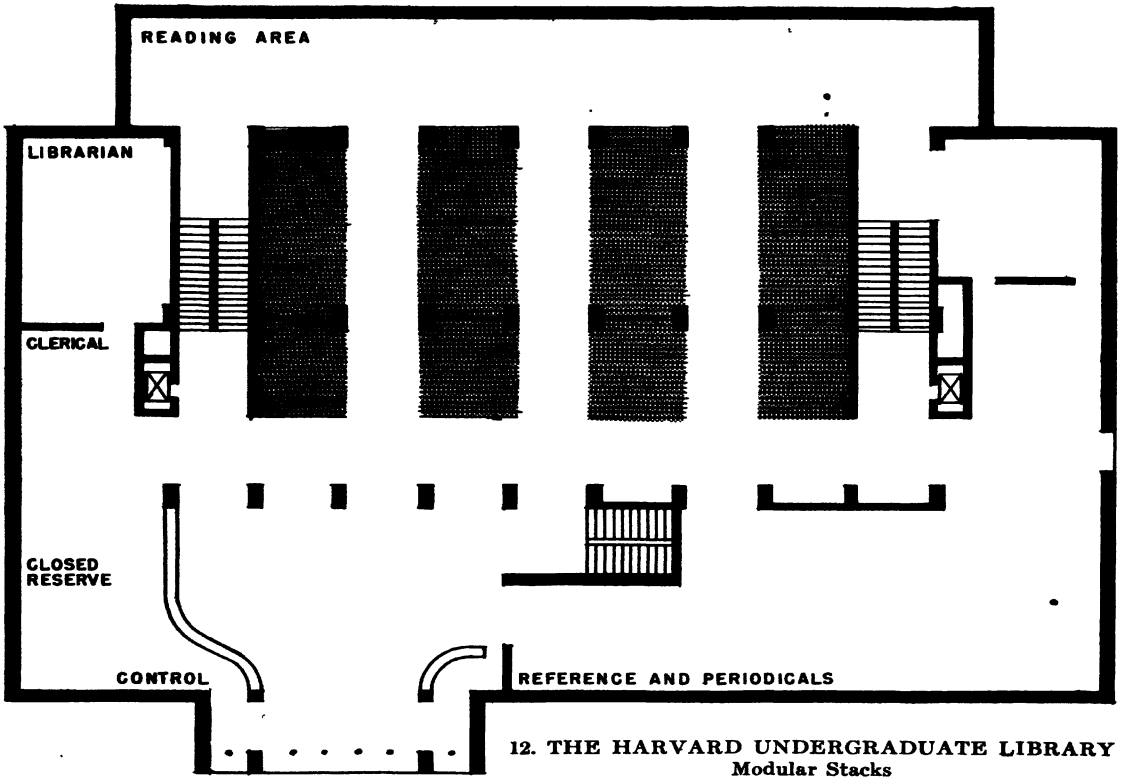

OFFICES AND SEMINARS



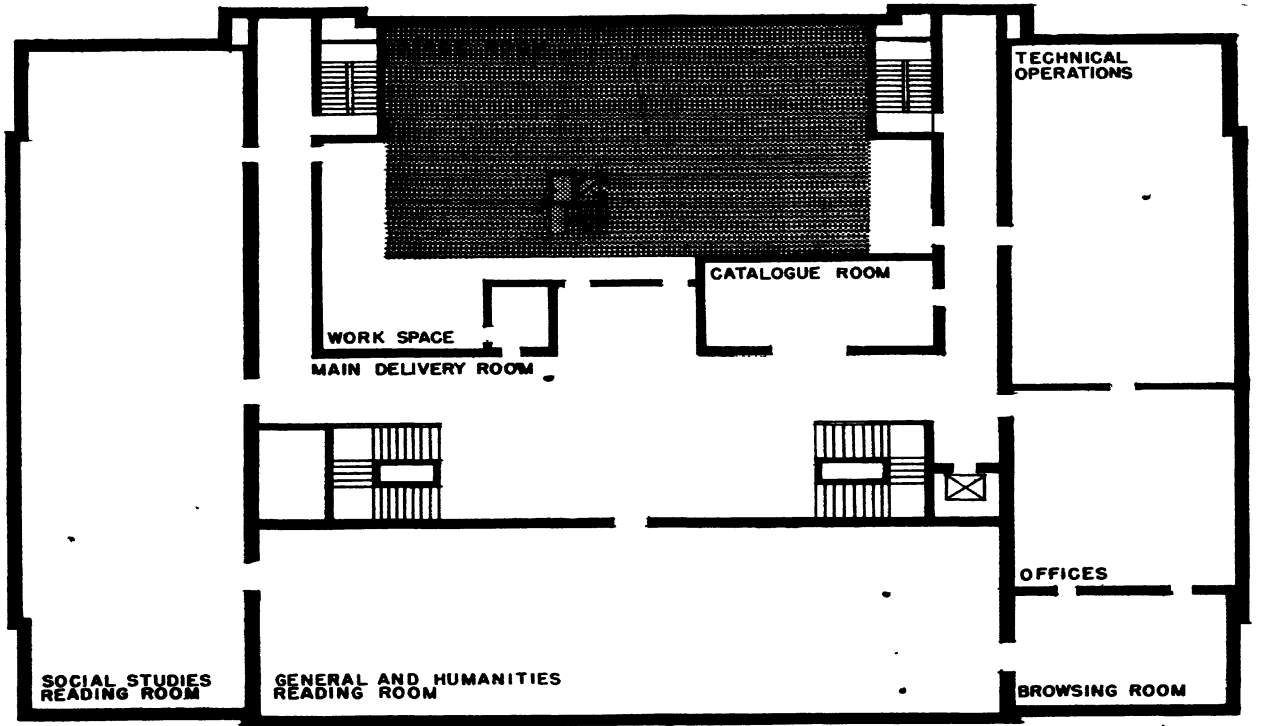
Stack "B." Floor Plan
10. PRINCETON UNIVERSITY
Modular Stacks



11. THE STATE UNIVERSITY OF IOWA
Modular Stacks



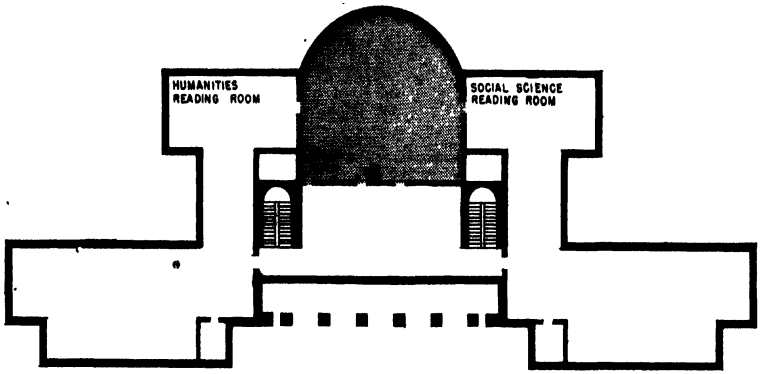
12. THE HARVARD UNDERGRADUATE LIBRARY
Modular Stacks



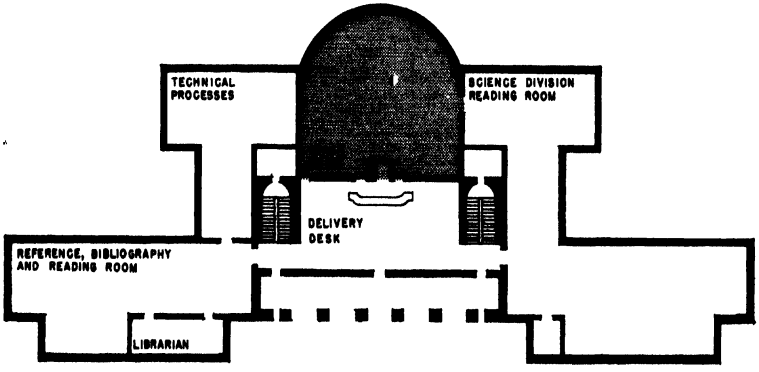
Second Floor Plan

13. THE UNIVERSITY OF NEBRASKA

Divisional Arrangements



SECOND FLOOR PLAN



FIRST FLOOR PLAN

14. THE UNIVERSITY OF COLORADO
Divisional Arrangements

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